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ABSTRACT

This report contains recommendations and guidelines for the development of a national computer education program for all Australian schools. The introduction provides background information on the appointment of the National Advisory Committee on Computers in Schools, including the guidelines and objectives set for it by the government. Chapter 2, the major part of the kit, is the 1983 report by the committee. It comments on the current use of computers in Australian schools and presents a detailed summary of school computing in the various states and territories. Information is also provided on computer developments in the United Kingdom and France, since both have introduced national computer programs. In chapter 3, the committee outlines a rationale for a national program and indicates the objectives that it believes the program should have and the principles that should support its development. Chapters 4 and 5 discuss the components that the committee believes should be incorporated in the program: (1) curriculum development; (2) professional development; (3) support services; (4) software and courseware; (5) hardware; and (6) evaluation. In chapter 6, the committee outlines the administrative arrangements that should apply to the program, and chapter 7 provides a summary of the recommendations made in the report. Appendices include extracts from the Commonwealth Government's Guidelines to the Commonwealth Schools Commission for 1984, a list of committee members and organizations who contributed to the report, recommended professional skills for various groups of teachers, suggestions for the hardware acquisition process, introduction of computers into the school environment, a glossary of terms, statements of dissent, and the response of the Commonwealth Schools Commission to the report. (JB)

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and Computers
1984 Information Kit

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Administrative and Funding Guidelines

The 1983 Report of the National Advisory Committee on Computers in Schools

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Contact Information for Program Committees

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How to use this kit

The Briefing Notes may be photocopied for use as discussion papers in staff and parent meetings. Involving the school community is one of the key priorities of the new program.

These discussions could be the basis for developing successful submissions for project funding.

The kit also contains source material.

The Advisory Committee Report

In April, 1983, the federal Minister for Education and Youth Affairs approved funds so that the Commonwealth Schools Commission could bring together an important committee.

By October, the Advisory Committee reached a substantial consensus on both the direction and detail of a national policy.

By reading the report, you can learn about the basic agreements among these important parties which underlie the new program.

Advice and Decisions

The National Advisory Committee on Computers in Schools reported to the Commonwealth Schools Commission. The Commission released the report, and after wide public discussion, formulated its advice to the Government. The Commission endorsed most of the Advisory Committee's fifty-two recommendations. It qualified other recommendations. The Government accepted the Commission's advice, and these decisions are set out in summary form. These decisions form the authoritative basis for administering the program.

Program guidelines

Following the Government's decisions, the Commonwealth Schools Commission prepared its administrative and funding guidelines for the new program. These program guidelines are set out in full.

The program guidelines give details about procedures and funding allocations, and may be useful both in preparing and evaluating project submissions.

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Commonwealth Schools Commission

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Briefing Notes:

Computer Education

The new, national Computer Education Program aims:

- To make it possible for students to learn about computer technology and its social impact;
- To integrate computers in appropriate ways across the whole curriculum.

The professional development of teachers will be a key priority in achieving these aims. Because of the finite resources available for this new initiative, in 1984 the emphasis will be on secondary schools.

Most Australian high schools now have some computer hardware. Mathematics and Science departments have generally led the way, and the uses of these computers have often been defined by individual teachers who were sympathetic to, and attracted by, the new information technology.

However, these developments have been somewhat selective in terms of the groups of students who have been reached. For instance, girls are disadvantaged if the computer resource is restricted to subjects which, for whatever reason, enrol a preponderance of boys.

All Australian students need to be prepared for the future, and on current indications they will need to find their way in an "information society". For this reason, all major interests—parent and teacher organisations as well as education authorities—have reached a consensus on a *broadly-based* program.

This broadly-based program will need to involve teachers who have not yet seen the need to come to terms with the computer, particularly in the Humanities and Arts curriculum area. It foresees a need to involve parents as well, and to create new educational material.

Given these concerns, the Commonwealth has identified the following matters of high priority:

- Professional development relevant to computers available for teachers, parents & other members of school communities.
- Computer awareness courses available for students.
- Uses for computers to be developed in as wide a range of subject areas as possible.
- Focus of the program to be on secondary schools in 1984.

The national Computer Education Program will be administered on the advice of a National Co-ordinating Committee on Computing in Schools, and Computer Education Committees in the States and Territories.

New South Wales, Victoria, Queensland, Western Australia, and Tasmania will have separate committees for government and non-government schools. For government schools, the education authorities in these States, on the advice of their committees, will submit programs to the Minister for Education and Youth Affairs for approval. For non-government schools, on the advice of their committees, the education authorities will submit programs to the federal Minister for approval.

In South Australia, the Northern Territory, and the Australian Capital Territory there will be joint committees, on whose advice the education authorities will submit the programs to the federal Minister for approval.

Following Ministerial approval, the programs will be implemented.

The Commonwealth wishes to see that programs in each State and Territory exhibit as many of the following characteristics as possible:

- Support greater equality of educational outcomes, particularly for girls and disadvantaged groups of students.
- Involve the whole school community, including parents.
- Enable decisions about the program to be taken at many levels of the education system.
- Co-ordinate activities of both government and non-government schools, and liaise across State boundaries.

This information kit contains contact information for State and Territory Committees.

You may also want to note the names and contact numbers of members of the Committee in your State and Territory inside the cover of this kit as they become available. (Appointments were not yet confirmed at time of writing.)

The National Advisory Committee on Computers in Schools reported to the Commonwealth Schools Commission on studies by its Technical Working Parties into various areas.

These areas are:

- Professional development
- Curriculum development
- Software/Courseware
- Support services
- Hardware
- Evaluation

The texts of the Advisory Committee report, Commission advice, and Government decisions are included in this information kit. The following Briefing Notes can be read against those texts.

Professional Development

This is a major priority of the national program in 1984. Professional development activities should have the following characteristics:

- may be part of a range of activities as outlined in Recommendation 13 of the report of the National Advisory Committee on Computers in Schools;
- in line with, and linked to, curriculum development priorities of the program;
- enabling teachers in a broad range of curriculum areas to develop skills and understandings in the use of computers and their impact on society, and in their application across the curriculum; women teachers and teachers in subject areas other than Mathematics and Science, as well as parents should be given particular consideration;
- associated with, and integrated into other CSC sponsored professional development activities.

Curriculum Development

In this area the national program has the following priorities:

- development of activities and experiences enabling all students to gain skills and understandings in the use of computers, and to learn about the impact of computers and information technology on society;
- the application of computing across the curriculum;

- the development of optional in-depth computer studies courses;
- focus on the particular needs of disadvantaged groups and girls.

Software/Courseware

Where proposals are for the acquisition or production of software or supporting materials for students or teachers the following criteria apply:

- a team approach for software development should be used, as outlined in Recommendation 32 of the NACCS Report;
- general purpose software (word-processors, data bases, etc.) may be purchased with program funds;
- software purchased or developed must satisfy valid educational needs, avoid stereotyping on a gender, ethnic or social basis, and facilitate progress towards more equal educational outcomes;
- programming languages to be supported include BASIC, LOGO, & PASCAL, and machine code. Fourth generation languages may be explored (Recommendation 35 of the NACCS Report).

Support Services

Where support services are established they should have the following characteristics:

- provide support to teachers and the whole school community, including parents (Recommendations 19, 21, 22);
- include the appointment of consultants, establishment of support centres, and the inservice education of curriculum consultants (Recommendations 25, 26, 27);
- may be small innovation grants to particular schools or groups of schools (Recommendation 27).

Hardware

Any hardware provided with national program funds should be in accordance with the following criteria:

- priority in the provision of funds for hardware should be given to Disadvantaged Schools & others serving needy communities (Recommendation 45);
- support only for the more powerful and versatile machines on the particular State contract list;
- be a minor part of funding allocation for 1984.

Evaluation

The evaluation of the program is most important, and should be undertaken at various levels.

- Some of the funds available for State Programs should be used to evaluate the programs at the school level, as well as monitoring the impact of the program at the State level.

Related Programs

The new Computer Education Program is just one of some thirty funding programs administered through the Office of the Commonwealth Schools Commission. These are described in The Commonwealth Schools Commission's *Program Guidelines 1984* which are sent free to all schools, and are available through Australian Government

Bookshops. That book sets out the administrative and funding guidelines for Commission programs, which will involve $1,400 million in grants in 1984. Some of the other Commission programs are relevant to Computer Education.

When funding from these other programs is used for computers in education, the priorities and principles of the Computer Education Program apply to the computer-related aspects of the program or project.

COMPUTER EDUCATION CO-ORDINATING COMMITTEES

Government Committee

Non-government Committee

New South Wales

Officer in Charge
Computer Education Unit
Department of Education
PO Box 16
ERSKINEVILLE NSW 2043
Telephone: (02) 519 4599

Contact CSC State Director for details.

Private Bag 811
MILSON'S POINT NSW 2061
Telephone: (02) 929 4933

Victoria

Ms Kate Alder
Information Officer
State Computer Education Centre
Bayside Learning Centre
Genoa Street
MOORABBIN VIC 3189
Telephone: (03) 555 8272

Contact CSC State Director for details.

17 Yarra Street
HAWTHORN VIC 3122
Telephone: (03) 810 0400

Queensland

Mr Ben Goodman
Co-ordinator Computer Education Program
Special Programs Operation Branch
Department of Education
PO Box 33
NORTH QUAY QLD 4000
Telephone: (07) 221 1175

Contact CSC State Director for details.

GPO Box 1331
BRISBANE QLD 4001
Telephone: (07) 229 5077

Western Australia

Mr Terry March
Schools Computing Centre
Laythorne Road
NOLLAMARA WA 6061
Telephone: (09) 349 0350

Contact CSC State Director for details.

PO Box 6032
PERTH HAY STREET EAST WA 6000
Telephone: (09) 325 5259

South Australia Joint Committee

Contact Officer,
Angle Park Computing Centre
Trafford Street
ANGLE PARK SA 5010
Telephone: (08) 268 5666

Northern Territory Joint Committee

Dr Terry Lane
Principal Education Officer
Computer Education
Professional Services Branch
Northern Territory Department
of Education
PMB 25
WINELLI NT 5789
Telephone: (089) 204 390

Tasmania

Ms Diane Hughes
Executive Officer
Tasmanian Government Schools
Computer Education Co-ordinating
Committee
Elizabeth Computing Centre
Elizabeth Street
HOBART TAS 7000
Telephone: (002) 306 691

Contact CSC State Director for details.

PO Box 1349N
HOBART TAS 7001
Telephone: (002) 204 446

ACT Joint Committee

Mr Ian Webb
Project Officer, Computer Education Program
Cook Primary School
Templeton St
COOK ACT 2614
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Teaching, Learning and Computers

Report of the National
Advisory Committee on
Computers in Schools

COMMONWEALTH SCHOOLS COMMISSION

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COMMONWEALTH SCHOOLS COMMISSION

National Advisory Committee On Computers in Schools

Commonwealth Schools Commission
PO Box 34
WODEN ACT 2606

The Commonwealth Schools Commission appointed this Committee in April 1983 to provide advice on the implementation of a National Computers in Schools Program.

In line with this direction we attach the Committee's report. Two members were not able to endorse the report in its entirety. Their reservations are set out in Appendix H.

P D Tannock (Chairman)
N Hoffman (Deputy Chairman)
D Ashmore
B Bahnisch
N H Campbell
L Connors
A Dunn
D Francis
J Hamilton
A Henry
G Inchley
G Kerr
M Miland
K Nash
L D Russell
D Sexton
D R Woodrow
B Young
R P McNamara (Executive Officer)
P Sandery (Consultant)

CANBERRA ACT
17 October 1983

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INTRODUCTION

For more than a decade computers have been used in Australian schools. There has been great variation in the rate of development between schools and education systems. Much of the initial impetus has come from the enthusiastic efforts of individual teachers and parents associated with particular schools. State education authorities have now all taken steps to promote and support the systematic development of computing in government schools. Non-government schools and system authorities are considering similar measures.

The Commonwealth Schools Commission, in its **Recommendations for 1984** released in February 1983, expressed the view that the development of a satisfactory program of computer education in Australian schools was of fundamental importance to Australia's future. After close examination of the present capacity of State and non-government school authorities to provide the necessary resources to implement an adequate program for computer education in the foreseeable future, the Commission concluded that Commonwealth initiative and support were essential. The Commission stated that without this assistance there would be only sporadic and partial progress towards the attainment of necessary goals in computer education.

In its Report, the Commission wrote:

> that the Commonwealth should commit itself to the development of a national computer education (or schools computing) program for all Australian schools, commencing in 1984. Such a program should be directed at the development of computing skills in teachers and students, awareness of the possibilities and importance of high technology, and the use of such technology for teaching and learning in schools . . .

and

> The Commission has examined the present capacity of State and non-government school authorities to provide the necessary resources to implement an adequate program within five years and has come to the conclusion that substantial additional resources are necessary. Indeed at the current rate of commitment, it will take many years for the bulk of government or non-government schools to reach the minimum standard necessary . . .

The Report then outlined a case for a national program, the components of that program and tentative objectives, and stated that a sum of $125m over 5 years was needed to achieve these objectives.

In policy statements prior to the March 1983 election, both major political parties promised support for schools computing.

In March 1983 the Commonwealth Schools Commission appointed the National Advisory Committee on Computers in Schools. In the same month the Minister for Education and Youth Affairs, Senator the Hon Susan Ryan, approved the provision of funds to cover the costs of administrative expenses associated with the Committee. The Committee was requested to provide an initial report by 30 September 1983.

On 28 July 1983 the Minister for Education and Youth Affairs announced the Commonwealth Government's Guidelines for the 1984 Schools Commission Programs. The Guidelines indicated that $18m (estimated December 1982 price levels) would be made available by the Commonwealth during the 1984–86 Triennium for a Computer Education Program. Of the total amount, $6m (estimated December 1982 price levels) would be available for 1984 with $4.8m being provided for government schools and $1.2m for non-government schools. The Government's Guidelines indicated that the Computer Education Program should have regard to the following objectives:

- the need for students to have an understanding of the uses of new technologies and their social, environmental, industrial and economic effects;
- planning for the use of computers in teaching and across the curriculum, and the impact of computer-based programs on the curriculum as a whole;
- professional development of teachers;
- access to the program by girls and disadvantaged groups;
- the economic use of resources including, where appropriate, support for the sharing of services between schools and sectors, and across States, and the standardisation of equipment and materials.

The Government also stated that initially the program would concentrate on secondary schools with the Commission being asked to prepare options on possible future policy directions beyond 1984, including extension of the program to primary schools. (Appendix A).

The Government has made the following allocation of funds between the States and Territories.

ALLOCATION FOR COMPUTER EDUCATION PROGRAMS FOR GOVERNMENT AND NON-GOVERNMENT SCHOOLS IN 1984

State/Territory	*Government Schools*	*Non-government Schools*
	$'000	$'000
NSW	1 545	337
Vic	1 282	339
Qld	676	176
SA	482	106
WA	447	114
Tas	239	71
NT	136	31
Sub-total	4 807	1 174
ACT	180	73
Total	4 987	1 247

The Committee is of the view that the cost estimates for all primary and secondary schools in Australia in the Commission's report **Recommendations for 1984** were reasonable. It is therefore recognised that the amount allocated for 1984 will not enable all stated objectives to be met, and hence priorities have been considered in formulating a reduced program to make most effective use of the funds available.

The National Advisory Committee on Computers in Schools was given the following terms of reference:

> The National Advisory Committee on Computers in Schools will provide advice to the Commonwealth Schools Commission on a broad range of matters relating to schools computing. In particular, it should provide advice on:
> - The use of computers in schools as they relate to the educational needs of boys and girls enrolled in primary, secondary and special schools;
> - The rationale for a national program, including desirable short and long term educational, social and economic outcomes;
> - An implementation plan, and associated guidelines, for the introduction of a national Schools Computing Program into primary, secondary and special schools, including its integration with State and non-government schools policies and provisions. This plan will include options for the allocation of funds among States and sectors, advice on desirable minimum standards of provision, and on ways of achieving an equitable sharing of resources and services across Australia;
> - A plan for generating and supporting discussion and awareness within the community and especially within school communities of school computing and its applications;
> - Evaluation activities relating to computing in schools and to the provision and operation of the proposed national program; and
> - Other matters which may be referred to the Committee by the Commission.

The Committee met on seven occasions from April to September 1983. At an early stage the Committee established six Technical Working Parties to provide it with specialist advice in a number of areas. Technical Working Parties were established in the following areas:

Professional Development
Curriculum Development
Software/Courseware
Hardware
Evaluation
Support Services.

The membership of each of these Technical Working Parties is listed in Appendix B.

The Committee received a comprehensive report from each of the Technical Working Parties. The recommendations made by each have been taken into account by the Committee in framing its advice to the Commission. The Committee wishes to record its appreciation of the work undertaken by the Technical Working Parties. The tasks set them were comprehensive and wide-ranging and the time for their completion was very limited.

The Committee undertook consultations with a range of national organisations which were either involved with or interested in the use of computers in schools. Consultations were also held with each State and Territory Computer Education Group or its equivalent. A list of the organisations consulted formally is contained in Appendix C.

Chapter 2 of the Report makes a number of comments about the current use of computers in Australian schools. The chapter also contains information regarding developments in the United Kingdom and France. In Chapter 3 the Committee outlines a rationale for a national program and indicates the objectives which it believes the program should have and the principles which it considers should support its development. Chapters 4 and 5 present the components which the Committee believes should be incorporated in the program while Chapter 6 outlines the organisational principles which it considers should be followed. A summary of the recommendations made in the report is given in Chapter 7.

2

THE PRESENT SITUATION

This chapter makes some comment on the use of computers in Australian schools and presents a detailed summary of schools computing in the various States and Territories. Information is also provided on developments in the United Kingdom and France. These two countries have been chosen as both have introduced national programs.

AUSTRALIA

Most secondary schools in Australia have at least one microcomputer. Throughout the country individual principals, teachers, parents and education authorities have decided that they can improve schooling by the use of computers. This decision has been made for reasons as diverse as carrying through a well-thought-out plan, being swayed by the enthusiasm of one or two keen teachers or parents, wanting to keep up with a nearby school, or just having a feeling that some computers are inexpensive and might be worth trying. Though there has been little co-ordination of this spread of computing, it has had many useful consequences for individual schools and for education systems.

Education Departments in some States introduced computing into their schools before microcomputers became plentiful and inexpensive, by installing a minicomputer in a central place and using it to provide a service to schools. Having made this decision it was essential that a centre be established with staff to operate the computer and provide support to the teachers who were using it. These States have been in a good position to co-operate with one another, and to decide their policies for dealing with the introduction of microcomputers. Most Education Departments now have a person or group responsible for computing in schools. A variety of provisions exists in non-government schools too. Many have microcomputers and some have their own minicomputers or lease time on a commercial installation.

Although the bulk of investment in computing has come from individual schools funds or from State government sources, various Commonwealth programs have already been used to assist schools to buy computers. The Commonwealth Schools Commission, through several of its specific purpose programs (e.g. Disadvantaged Schools, Special Projects) has provided some funding, as has the Department of Education and Youth Affairs, through the Transition Education Program. Commonwealth support for curriculum materials and software has come from several sources. The Curriculum Development Centre, through its Social Education Materials Project, produced materials dealing with the effect of computers on society. For the past three years the Department of Science and Technology has distributed computer materials to schools during the annual Information Technology Week.

Generally, Commonwealth support for curriculum development and software production for schools has been very limited. Most activity in this regard has taken place at the State or school level. In some States staff of computer centres have developed software and curriculum materials. So too have many individual teachers. Although some of this material is comparable to the best that has been produced overseas, in general there is a serious lack of curriculum material and quality software available and suitable for Australian schools. There is a growing volume of material available from the United States and Britain. This is likely to have a major impact on schools in the future.

Set down below is a detailed statement of the present state of computing in Australian schools. The situation in State and Territory Education Departments and government and non-government schools is summarised. The material on the government sectors was supplied by Education Departments and concentrates primarily on what has been achieved within the various systems. The Committee believes that if Australian schools and their students are to meet the objectives outlined in Chapter 3 of the Report it is necessary to recognise that only a start has been made and the greater part of the work lies ahead. A firm commitment for the planning and provision of resources is needed and the Committee reiterates the opinion expressed in Chapter 1 that no system has or is likely to have the resources necessary to enable it to reach the objectives stated without the assistance of a National Program. While each sector (government and non-government) can report activities in computing, some of them innovative and spread across the whole State, these activities generally impinge on only a small part of the school population. It is apparent from a survey of the equipment actually in schools, that many students have little or only token contact with computers.

GOVERNMENT SCHOOLS

New South Wales

SYSTEM LEVEL ACTIVITIES

Late in 1982 the New South Wales Minister for Education issued a General Guideline Statement on Computers and Computing in Education. He suggested that the primary goal for introducing computers into schools should be to provide 'computer awareness for all'. In August 1983 the Minister released the Department of Education's general policy statement on computers in schools. This includes a list of minimum goals to be achieved before students leave school.

The Secondary Schools Board (years 7–10) and the Board of Senior School Studies (years 11–12) have approved many computer related courses developed by schools. In late 1982, the Secondary Schools Board established an Advisory Group on Computer Education which recommended that Computer Awareness should be a part of the core curriculum in the compulsory years of schooling, and that optional courses in Computing Studies should be included in the School Certificate. A syllabus committee has been established by the Board to produce both kinds of syllabus. A Curriculum Project Team representing a range of interest groups has also been established by the Department to develop a statement of principles for Computer Education K–12 and to co-ordinate curriculum development for the use of computers in primary schools.

A Computer Education Unit has been established at Erskineville with five full-time professional staff members. The Unit brings together work on curriculum development; the evaluation, development and distribution of software and other resource materials; consultancy, support and in-service education of teachers; and advice on the selection of computer equipment for schools. In its support role, the Unit works closely with consultants in the regions. The Unit has been equipped with Apple II and Microbee microcomputer equipment. At least one microcomputer has also been issued to each region for professional development activities associated with computing.

In the professional development of teachers, the Directorate of Studies has conducted State workshops, the Computer Education Group of New South Wales is making a valuable contribution, and the State Development Committee has approved many in-service courses, including those run by Colleges of Advanced Education.

SCHOOL LEVEL ACTIVITIES

In secondary schools the main uses of the computer until now have been in the teaching of programming and computing studies. As a greater variety of educational software becomes available, schools are beginning to use the computer as a teaching aid. Teaching about computers occurs at this stage mainly through locally developed school courses approved by the Secondary Schools Board, and in courses developed by schools for students in years 11 and 12 and approved by the Board of Senior School Studies. The initiatives taken by schools are hampered by the lack of sufficient educationally sound software and by the high student:computer ratio. It is estimated that there are approximately 2200 microcomputers in New South Wales government secondary and primary schools. Activity in primary schools is still at a low level compared with that in secondary schools, but it is increasing rapidly as more schools acquire microcomputers. The use of computers for administration and resource management is accorded a relatively low priority. The prime purpose of using computers is seen as an educational one, and normal criteria of effectiveness and efficiency must determine decisions about administrative uses.

RECOMMENDED HARDWARE

Schools may acquire computer hardware through the Annual Requisitions Scheme and by the use of funds raised by parent groups. The Education Department recently called for new tenders for computing hardware for schools. The new contracts should be announced prior to the 1984 school year. The 1982–83 contract was for the Apple II and the Microbee 16. Servicing of microcomputers currently and recently on contract is carried out by the Government Supply Department.

Victoria

SYSTEM LEVEL ACTIVITIES

During 1982, a general management restructure commenced in the Victorian Education Department. Within the new structure, a P–12 Computers in Education Curriculum Committee was established to provide advice to the Director of Curriculum and the Executive Director (Educational Programs). In addition this group will be concerned with information dissemination, advice to schools, in-service proposals, curriculum guidelines, and software and hardware requirements of the curriculum. The Director-

General of Education has formed a broadly representative expert committee which advises him on all matters concerning the use of computers in schools. Departmental policy has been determined on the basis of advice received from this committee.

General policy is based upon the notion that there is a need for children to be prepared for living in a society which is fast becoming dependent on the widespread application of computer technology. Many schools regard computer awareness as a requirement for all students, while Computer Studies is a desired subject for many. A series of suggested syllabi for Computer Awareness and Computer Studies has been prepared for years 9, 10, 11 and 12. Similar guidelines have been developed for Business Education. The Victorian Institute of Secondary Education offers Computer Science as a Group 1 Higher School Certificate subject.

A Computer Education Task Force has been established with seven full-time professional staff. The Task Force is concerned with software/courseware development, maintenance and distribution, central and school based in-service programs and the provision of consultant services to schools. It is based at the Ardoch Village computing centre which was established several years ago with one consultant and a small amount of microcomputer equipment. Many regions have at least one computer consultant to provide advice to schools and to undertake in-service activities.

The State Professional Development Committee has established priorities for schools computing in-service activities and has developed a statewide in-service program. This program is complemented by the activities of the Computer Education Group of Victoria which provides a valuable range of services to teachers, including a comprehensive annual conference.

The State Board of Education is developing a proposal for a curriculum project which embraces high technology in a broad context. The proposal is expected to be considered for 1984.

SCHOOL LEVEL ACTIVITIES

Education Department policy requires schools to accept responsibility for their own curriculum. The guidelines that have been developed for Computer Studies and Computer Awareness assist schools to develop computer courses.

While courses of this nature are valuable, the Education Department wishes to encourage more general applications of computing across the curriculum and therefore the Computers in Education Curriculum Committee is preparing additional guidelines to schools on this matter. The use of packages to assist learning is as widespread as the limited availability of equipment and suitable good quality educational software will allow. Word processing is used in nearly every school that has suitable facilities. Some school administrative applications have been developed, but these are given lower priority than that allocated to educational use. Primary schools computing activity is still at a low level, but is increasing rapidly.

RECOMMENDED HARDWARE

The Victorian Government has a system of selected suppliers of microcomputer equipment. The Micromation and Option II microcomputer systems are supplied under this system, and were recommended by the Technical Schools Division. Schools are not bound by this arrangement and the Education Department has not specified other brands of equipment, although software and in-service support is only provided for Apple II, Cromemco, Micromation and Micromation compatible CP/M systems. Some financial assistance has been made available from discretionary funds, but most equipment has been purchased using locally raised funds.

Queensland

SYSTEM LEVEL ACTIVITIES

A policy statement concerning schools computing activities has been approved and distributed. This encompasses priorities, curriculum development, equipment and materials, teacher development and investigations for each of the Schools Divisions. The network of support services provided by Branches in the Division of Curriculum Services is also included in the policy statement. The Computer Policy Advisory Committee includes representatives from each Division and has prepared reports for the Director-General of Education in 1979 and 1982.

Curriculum Branch established a Microcomputers in Schools Study in 1980 which was succeeded by the Computer Education Curriculum Project in 1982. Design, development, and where appropriate, revision of syllabus documents and curriculum guidelines are currently being undertaken. Some software and supporting documentation have been developed. Library and Resource Services Branch's direct involvement also dates from 1980. In 1983 a Schools Computing Services Unit was established in the Branch. Advisory services to schools include technical advice, assistance in planning, in-service activities and assistance with information storage and retrieval. Staff deployed in the Computer Education Curriculum Project and the Schools Computing Services Unit now total the equivalent of 9.5 full-time officers.

The Division of Special Education has established the Special Education Computer Assisted Learning Committee which is conducting a pilot program based in selected schools. The Division is also developing plans for extensive information networking as part of a Divisional information policy.

The wide distribution of schools poses particular difficulties for professional development of teachers. A number of seminars has been organised and school visits conducted using personnel based in Head Office, and information disseminated through a variety of publications. Support of schools is also being developed within the nine Educational Regions in the State.

Teachers who have sufficient expertise to assist others have been identified in several regions. In-service activities have been based on the after-hours use of school facilities, on Education Centres, and, in the case of two regions, on mobile vans. In addition to calling on system level personnel, regional staff have also made use of expertise and equipment from Colleges of Advanced Education and commercial suppliers.

SCHOOL LEVEL ACTIVITIES

More primary, secondary and special schools are acquiring microcomputers, as indicated by the following figures:

February 1981: 160 schools— 310 computers
February 1982: 228 schools— 643 computers
February 1983: 420 schools—1 550 computers

Programs conducted in schools include computer studies, computer awareness and computer assisted learning. Reference to computers, or use of the computer as a learning resource may be made in various curriculum areas. There is an increasing interest in the use of microcomputers in school resource centres and in school administration. Access to appropriate software and sufficient equipment is still a limiting factor.

RECOMMENDED HARDWARE

Several systems are evaluated and a selection made to be placed on government contract for supply to schools. In 1983 these are the Apple IIe, Tandy TRS 80 Model III, Tandy Colour, Microbee and BBC.

South Australia

SYSTEM LEVEL ACTIVITIES

A policy statement on computing in schools has been issued to all schools by the Education Department. Policy level responsibility for computing in schools rests with the Assistant Director-General of Education (Resources) and day-to-day responsibility with the Principal Education Officer (Computing/Technology).

In addition to the Principal Education Officer, there are eight professional staff and four support staff in the Schools Computing Section and several regional advisers. The Schools Computing Section is a component of the Curriculum Directorate of the Education Department. Officers from this section provide schools with advice on all aspects of schools computing, develop software and conduct teacher professional development activities. The Schools Computing Section is located at the Education Department's Angle Park Computing Centre. This centre provides schools with a batch card input system and with access to two extensive microcomputer networks. Microcomputer equipment is lent to schools and curriculum committees.

A special purpose microcomputer has been developed by the Special Education Section of the Education Department for use by severely handicapped children. Recommended Computer Awareness and Computer Studies courses have been prepared for use by schools. There is a Computing Curriculum Committee which functions as a development and advisory group to schools. All other curriculum committees have one or more representatives on a general computing group which looks at implementing computing applications in all curriculum areas. There is an extensive in-service program for computing activities in secondary schools and a growing program to serve the primary area.

SCHOOL LEVEL ACTIVITIES

Approximately 90 per cent of secondary schools offer all or part of the recommended Computer Awareness course somewhere in years 8–10. Computer Studies courses (developed by the school or Education Department Curriculum Committee) are offered in years 8–12. The major emphasis for computing has always been to integrate it into the school curriculum. Teaching with computers occurs to some degree in all subject areas and is limited mainly by the availability of a sufficient quantity of software and access to hardware.

Approximately 95 per cent of secondary schools and 20 per cent of primary schools have at least one microcomputer. At least 30 schools have installed Local Area Networks with an average of 11 microcomputers in each network to provide increased student and teacher access to interactive facilities. Some schools use microcomputers as an administrative aid and the Angle Park Computing Centre provides access to a database system for school scheduling and other curriculum support activities.

RECOMMENDED HARDWARE

The Apple II is supported at secondary and primary level as a teacher professional development and teacher demonstration ('electronic blackboard') system. The BBC microcomputer is recommended as a system for use by students both in stand-alone and Local Area Network mode. Financial responsibility for hardware purchase now rests with individual schools.

Western Australia

SYSTEM LEVEL ACTIVITIES

The Education Department of Western Australia has clearly defined policy statements issued to schools by the Director-General of Education for both secondary and primary schools. Policy level responsibility for schools computing rests with the Director of Educational Services and day-to-day responsibility with a Superintendent of Education.

The Schools Computing Branch has six full-time professional staff and five technical staff. These officers provide schools with advice on hardware, software and pedagogic matters and carry out all other functions associated with the activities supported by the Schools Computing Centre. This centre is located at Nollamara and provides a range of dial-up and on-site services to schools. Nine portable microcomputers are available for loan to country schools, mainly District High Schools.

The Schools Computing Branch has developed a number of Computer Assisted Learning packages and an arrangement has been established to allow this material to be sold commercially by the Systems Research Institute of Australia. During 1982 the Education Department embarked on a major revision and upgrading of the information processing courses in secondary schools, leading to the development of Information Processing (General) and Information Processing (Applied) courses for lower secondary schools. Moves are being made to establish a matriculation course in Information Processing. The Education Department supports an extensive in-service program for school based personnel, with the occasional use of outside experts where necessary.

SCHOOL LEVEL ACTIVITIES

A comprehensive set of courses has been developed by the Schools Computing Branch for use by schools. Approximately 80 per cent of secondary schools are offering a computing option in years 9 and 10, and around 40 per cent are offering a computer awareness course at year 8. The new Information Processing (General) course is being trialled in five pilot schools in 1983.

Computers are being used as a teaching aid in a range of subjects. A limitation on this use of computers is the relative lack of high quality software appropriate to the educational programs of Western Australian schools, although an effort is being made to reduce this problem. In primary schools work has commenced to integrate the computer into the teaching-learning program.

Little support is provided for administrative applications of computers in schools although a timetabling system is available through the Schools Computing Centre. This package is used by most high and senior high schools.

RECOMMENDED HARDWARE

The Education Department subsidises purchase by schools of recommended hardware on a dollar-for-dollar basis (up to a maximum set amount per school and within a total subsidy budget for a given financial year for a specific number of schools per year). The BBC microcomputer is the current approved system for primary schools. At the secondary school level support is provided for the existing in-school equipment and for the recently recommended systems which are the CP/M based, Microbee 64 and (provisionally) the BBC microcomputer with Z80 second processor. Equipment approved for school purchase is fully maintained by the Public Works Department. All high and senior high schools and approximately one-third of the district high schools (K to 10) have installed (or have ordered) at least one microcomputer.

Tasmania

SYSTEM LEVEL ACTIVITIES

The Director-General of Education receives advice on computing from the Computer Management Committee. This Committee determines policy guidelines which are the responsibility of the Officer-in-Charge of the Elizabeth Computer Centre to implement. The Education Department's schools computing centre, the Elizabeth Computing Centre, is the focus for computing activities of Departmental schools in Tasmania. The ECC maintains an extensive network (TASNET) of minicomputers supporting approximately 330 terminals in schools, colleges and other sites throughout the State.

The ECC has a total staff of 22, of which eight are involved directly in the support of educational computing. This Centre provides advice to schools, develops software both of an educational and administrative nature and maintains and develops the network to which schools have access. In 1982, the ECC produced a First Fleet microcomputer package for distribution to Australian schools as part of Information Technology Week. The Department of Science and Technology is sponsoring the Elizabeth Computing Centre to develop a similar package for 1983. This package is based on data collected during an Antarctic expedition.

Higher School Certificate Computer Studies has been available to students for eleven years. School Certificate Computer Studies courses have also been developed in addition to three computer literacy courses compiled by the ECC.

Microcomputers are available for loan to schools from the ECC to supplement existing school equipment. In-service activities are conducted throughout the State. The Centre for Continuing Education for Teachers also offers computing courses of approximately seventy hours duration.

SCHOOL LEVEL ACTIVITIES

Students taking HSC Computer Studies would normally use the TASNET system rather than a microcomputer. The microcomputers are used more to support computer literacy courses or for activities involving teaching with and through computers. The emphasis of the computer literacy courses is generally on social implications and hands-on experience is directed towards the use of software packages.

In primary schools the emphasis is on computer assisted learning, computer awareness and problem solving. Seven Special Schools now have microcomputers, but there is a need for development of wider variety of suitable software in this area. Access to administrative software is provided to schools via TASNET. This includes applications for libraries, the Media Centre, for student moderation and for the processing of school student and staff records.

All schools have access to interactive computing equipment through TASNET, microcomputers, or both. These terminals are used for a variety of activities including library functions, bookings for audio-visual equipment and school administration.

RECOMMENDED HARDWARE

The recommended system for primary schools is the BBC microcomputer. For secondary schools, support is provided for both the BBC microcomputer and the Apple II. Hardware acquisition is a school responsibility, but maintenance for approved systems is provided free of charge by the Tasmanian Media Centre and software for approved systems is developed by the Elizabeth Computing Centre.

Northern Territory

SYSTEM LEVEL ACTIVITIES

The Northern Territory Department of Education has issued a policy statement for computing in schools. Implementation of this Computer Education Policy in Northern Territory primary and secondary schools is the responsibility of the Mathematics and Computer Education Unit in the Curriculum Section of the Professional Services Branch. A Computer Education Centre is in the process of being established in conjunction with the Darwin Community College and should be operational by 1984 with a professional staff of four.

Computer Education has been declared one of the key areas of the Northern Territory core curriculum. Computing in Northern Territory schools is based on the use of microcomputers. At the secondary level there are nine accredited Computer Studies courses. These are in the process of being rationalised to reduce the number to three Senior Accredited Courses, and South Australian SSC courses are being introduced in 1984 in several schools. In-service and advisory support is provided to government and non-government schools for a variety of computing activities. Provision for computer facilities is included in the design brief for all new schools.

SCHOOL LEVEL ACTIVITIES

All secondary schools in the Northern Territory have computing facilities ranging from at least one microcomputer to complete computer rooms, in one case fully networked.

All offer some form of computer awareness course. At the senior secondary level, schools offer one or more of the accredited Computer Studies courses. More than half of the urban primary schools now have at least one microcomputer, and the major emphasis is on awareness through hands-on experience. Other activities such as the use of computer assisted instruction and learning have been restricted by the lack of suitable software and hardware.

RECOMMENDED HARDWARE

Until the end of 1983 when the situation will be reviewed, the recommended systems are the Apple II/IIe, BBC and VIC 20 microcomputers. A generous subsidy is provided to assist schools to purchase approved equipment.

Australian Capital Territory

SYSTEM LEVEL ACTIVITIES

In November 1981 the ACT Schools Authority issued a discussion paper on computers and education in ACT schools, but it has not yet made a policy statement. It is generally held that all students should be given the opportunity to become computer literate. A number of in-service courses are conducted each semester, the majority being aimed at effective use of computers in the classroom and computer awareness for teachers and students.

SCHOOL LEVEL ACTIVITIES

Every high school in the ACT offers some form of computing course, ranging from computer awareness to computer programming. Approximately 80 per cent of primary schools use microcomputers to develop problem solving skills and computer literacy. Many schools are also using word processing packages to support process writing. All secondary colleges offer a tertiary accredited two-year Computing Studies course and most offer an accredited one-year Computers in Society course.

RECOMMENDED HARDWARE

The Apple II is recommended as the most suitable system for classroom use, although schools are free to make their own decisions regarding choice of hardware.

NON-GOVERNMENT SCHOOLS

The non-government school sector comprises a diverse array of schools; some are systemically organised and others are independent of any system. The overall situation regarding computer use in non-government schools is, therefore, not easily assessed. However, information obtained through surveys conducted by the National Council for Independent Schools, the various Catholic Education Offices and State Education Departments gives a reasonable indication of the situation regarding computer use in non-government schools across Australia.

SYSTEM LEVEL ACTIVITIES

The use of the word 'system' in the context of non-government schools refers to the totality of non-government schools within a State or Territory or to identifiable groups within the totality such as Catholic Schools and member schools of the respective Associations of Independent Schools. There is some minimal co-ordination of activities at a system level. In some States, committees or working parties have been or are being established to examine questions related to computer use in schools and in one State a consortium of a number of non-government schools has been formed. Most non-government schools are influenced by policy statements and guidelines issued by the State Education Departments.

In some States there has been co-operation between non-government schools and the government school sector. This co-operation has featured a significant level of reciprocal sharing of facilities and expertise. Support Centres where they exist, primarily service government schools, but there are instances where non-government schools use the facilities of these centres, on a free access or 'user pay' basis, and professional advice is sometimes available. Informal liaison between systems and schools is achieved by teacher membership of local or State Computer Education Groups and the Professional Development Programs in all States extend to teachers of all schools. Considerable dissemination of information is provided by publications distributed by these computer education groups and releases from State Education Departments.

SCHOOL LEVEL ACTIVITIES

As in the government sector, non-government schools exhibit a considerable diversity in the level and extent of activity in the use of computers; in the expertise of personnel involved; and the effectiveness of the programs which have been implemented. The variation extends from a large number of schools which have taken no steps to introduce computers into the curriculum to some schools which have developed quite sophisticated computing programs. The level of activity would appear to depend on the priority given by respective school authorities to computer education and on the limitations imposed by the personnel and facilities available.

Some larger non-government secondary schools introduced computing programs prior to the advent of the microcomputer, and through the use of minicomputers provided facilities for teaching and administration. Considerable staff expertise has been developed in the schools over a period of time and this resource could prove valuable for in-service activities in the implementation stage of the Computer Education Program.

In these schools, priority has been given to Computer Awareness courses. Accredited courses in Computer Science or Computer Studies have also contributed to the introduction of computers into senior classes. Emphasis has also been placed upon teaching by computer, teacher support and school administration. Many schools are also conducting computer sessions for parents and teachers. Most of the primary schools have had little or no contact with computing.

HARDWARE

As with government schools, there is a wide range of computing equipment in non-government schools, most of which lacks educationally sound software. Those schools which have computing facilities have indicated that in excess of 95 per cent of those facilities were obtained through parent associations or general school funds. The great majority of computers in use in non-government schools are microcomputers and a small but increasing number of schools are introducing local area networks. In recent years, the non-government schools have tended to look to respective State Education Department specifications for guidance in the acquisition of computing equipment.

UNITED KINGDOM MICROELECTRONICS EDUCATION PROGRAM

In March 1980 the United Kingdom Government announced the 'Microelectronics Education Program' (MEP) to promote the development and use of microelectronics in schools. The Government allocated $A7.4m annually to support the MEP. The aim of the program, which is to be completed by 1986, is to help schools prepare students for life in a society in which devices and systems based on microelectronics are pervasive. The program supports curriculum development, teacher education, resource organisation and support, and the establishment of a network of regional information centres.

In specific terms, the MEP aims to:

- provide and disseminate information to keep teachers informed of developments in schools computing;
- provide in-service training opportunities for teachers;
- develop curriculum materials for use in the classroom and for teacher in-service activities;
- maintain links with industry and advise on hardware purchases;
- evaluate educational software.

As an integral element of the United Kingdom schools computing strategy, the Department of Trade and Industry, through its Micros-in-Schools scheme, is providing a further $A23m aimed at enabling all secondary schools in the country to purchase a microcomputer by the end of 1982, and all primary schools by the end of 1984. Three British manufactured microcomputers are supported through the Program and a subsidy is provided to meet 50 per cent of the cost of purchasing one machine for each school. In January 1982, in association with the Micros-in-Schools scheme, a major computer literacy project was launched, built around a ten-part television series.

Professional development for teachers is a significant element of both programs. It is a prerequisite for participation in the Micros-in-Schools scheme that at least two staff members from a school attend training courses in the use of computers in education. This in-service is provided by MEP and almost one-third of MEP funds are devoted to in-service activities. The bulk of the training is aimed at those teachers who already have some experience to assume responsibility for further development in their own classrooms and for conducting shorter familiarisation courses for other teachers. Notwithstanding its limited resource commitment, the United Kingdom scheme has produced remarkable progress in the development of schools computing in a relatively short time. Nevertheless it remains a fact that many United Kingdom primary and secondary schools still have only very minor access to computing for the bulk of their students.

FRANCE: MICROS-IN-SCHOOLS PROJECT

The French Ministry of Education in 1970 launched a $A20m plan to introduce computing into senior high schools. The aim of the plan was to familiarise teachers and students with the use of computers and to demystify computing by using it as an educational aid rather than as an end in itself.

The initial move, jointly funded by the Ministry of Education and by industry, was to introduce multi-terminal minicomputers into 58 schools. The hardware and software used was produced in France. At the same time as the equipment was introduced, 600 teacher volunteers, drawn from a variety of teaching disciplines, attended a full-time training course of six or twelve months duration in computer techniques. The initial experiment finished in 1976 and the subsequent evaluation suggested that the program goals had been achieved. As indicated earlier the total cost of equipment and training over the initial six-year program was around $20m, with the overwhelming portion of cost being for the training. A more ambitious program was then designed to follow up this success.

The decision was taken in 1980 to equip 200 schools each year with a microcomputer resource centre (eight microcomputers in a network with a common printer) with a target of 10 000 installed systems by 1986. The estimated hardware cost was around $40m, to be shared by the Ministries of Education and Industry. As with the United Kingdom Microelectronics program, the French scheme specified a small number (two) of locally produced microcomputers.

Two problems were recognised in this full-scale dissemination of computer hardware to schools:

- how to provide for professional development on a scale that ensured that teachers had the skills to enable them effectively to use the equipment;
- how to develop a sufficiently large set of relevant and high quality software.

The proposed solution to the first problem was to establish a series of twelve-day courses to introduce teachers to computing. This solution was not acceptable to teachers who felt that it was far too short a time to enable them to gain sufficient skill to be able to use computers creatively in their classrooms. A scheme has now been devised that involves one-year full-time computing courses for between 100 and 160 teachers in each year in centres set up throughout the country. These courses are intended to ensure that in every school there is a core of highly trained teachers familiar with the use of the computer and capable of producing educational software for use in classrooms. One notable feature of teacher selection is that those from other than mathematics/science disciplines are given priority in selection to avoid the possibility of computing being concentrated in the scientific courses.

Of direct relevance to the French schools computing program is the 'Telematique Français', an all-embracing framework for facilitating the rapid and widespread introduction of information technology throughout the nation and the development of an indigenous high technology industry.

3

A NATIONAL PROGRAM: RATIONALE, OBJECTIVES AND PRINCIPLES

In this chapter the Committee sets out a rationale for a national Computer Education Program, outlines the objectives of the Program and indicates the basic principles which should guide its development.

WHY A NATIONAL PROGRAM?

The Committee believes that it is essential to the well-being of Australian society that schools provide students with knowledge of the electronic information technologies and skills in their use. If this does not happen, Australia will be severely disadvantaged in relation to other countries. (For the purposes of this report the Committee has used the definition of information technology adopted by UNESCO: see Appendix G.)

Governments will have to make deliberate efforts to enable students in all sections of society to participate fully in the developing information technology and its consequent cultural changes. There is extensive evidence that the outcomes and rewards of education are distributed unequally between different groups. The acquisition of computers by the public at large may serve to reinforce these trends. Computers tend to be acquired by the households of those students who already seem to gain most advantage from schooling. Historically the manner in which computing has been introduced into many schools has associated it with mathematics. This linkage of computers with high level competence in mathematics is an approach which deters some students from participation. A national program can help ensure that schools and systems have adequate resources to provide access to computing for all students. Further, a national program could give high priority to encouraging schools and school systems to design and implement computer related curricula in ways which make special provision for the removal and prevention of inequalities based on gender, socio-economic or cultural differences, or regional location.

Many schools have begun to use computers, but there will be advantages in greater co-ordination of their efforts and a sharing of resources. A nation with a population as small as Australia's cannot afford to delay the sharing of its resources for supporting computing in schools, especially in the slow and expensive process of writing, assessing and disseminating software and in adapting curricula and teaching techniques to the changing needs of society. A national program can assist in the reduction of the unnecessary duplication of effort that is already occurring. It can also assist school authorities to deal with the difficult problem of selecting equipment in a way that faces the realities of the marketplace and yet gives schools the benefits of economy of scale when they are buying equipment and supporting it with software.

A national program will assist in the co-ordination of diverse activities across the nation, and help overcome the lag in the development of computing in schools by providing the means for national co-operation in planning a program of professional development and fostering changes in pre-service education. Advantages will be gained by the exchange of software, curriculum materials and other information. The Committee believes there are advantages in developing national educational guidelines and specifications for hardware and software as well as fostering or commissioning national research and evaluation and arranging for the dissemination of results. The program will supplement the resources of schools, or school systems, or both, and so assist them to acquire and maintain an appropriate level of hardware, develop and distribute curricula and support materials, evaluate and distribute information about curricula and support materials and provide a range of support services.

Many Australian inventions gain worldwide recognition, but often their development takes place overseas, with the benefits going to the country that develops them. A national program can be a means of encouraging the growth and development of the Australian computer industry, and could lead to sales of both hardware and software in the domestic market. The challenge for industry is to demonstrate its ability to compete in meeting educational specifications. A national program also provides a chance to focus Australian skills on creating a significant export market, for example in software and integrated systems. Teachers everywhere need high quality educational computer software. The design and writing of software is labour intensive, not capital intensive, and there is a huge potential market for high quality material overseas. A national program can provide the means of determining software needs, establishing standards and guidelines for developing software, co-ordinating production, and promoting the products to attract the attention of other countries.

The Committee recognises that there are considerable disparities in the computer facilities and computer education programs now available for students. It believes that a nationally funded program is needed to enable all Australian schools to have appropriately trained staff with access to an acceptable level of resources, both hardware and software, in order to offer worthwhile educational programs which require computer facilities. It believes that support for a national program on the use of computers in schools would assist in improving the quality of schooling. Finally, the Committee believes that a broader program on the use of computers in schools would contribute to the national well-being by enabling all students to become technically more aware, and by enabling some students to develop higher level skills which will contribute to their employment.

AIMS AND OBJECTIVES OF THE NATIONAL PROGRAM

The general aim of the national program is to assist teachers, school administrators, and resource managers to provide students with the resources to learn about and to use computers and computing. Each school system, and indeed each school, will undoubtedly develop and refine its objectives in computing. From the Committee's perspective, however, the desired outcomes of schools computing programs are set down below.

Students should learn to:

- use computers for inquiry, analysis, information processing, problem solving and recreation;
- make informed and responsible judgments about those aspects of computer use that affect them and others in economic, social, political and physical contexts;
- recognise the sort of problems that are not amenable to computer solutions;
- become conversant with the broad characteristics of the hardware and software with which they are working and acquire the capacity to make a consumer evaluation of such products;
- undertake a formal study of information processing or appropriate aspects of it.

The extent to which students will achieve the aims set out above depends on teachers being sympathetic to the aims and competent to teach with and about computers, on school administrators being able to include computing in school programs and to enlist school and community support for it and on resource managers being able to provide teachers, equipment and support services.

Teachers should:

- study and experience the use of computers in schools through pre-service and in-service courses, especially if they belong to groups who might have been excluded from computing in the past;
- be informed about the implications of the computer and related technology and be aware of ways of using them to meet the needs of each student which are consistent with the educational principles underlying the rest of their teaching;
- experiment with imaginative and effective use of computers in schools;
- use computers for their own word processing, database management, graphics manipulation;
- develop, implement and evaluate curriculum in their schools in response to changes in information technology; and
- participate effectively in decision-making processes associated with school use of computing systems.

Principals and in-school administrators should:

- organise schools so that all students have opportunities, within their broad general education, to learn about computers and their use;
- see to it that the potential of computing is fully used for special education;
- ensure that, within the school, students are not disadvantaged in access to computing because of socio-economic background, race and gender;
- use computing systems to enhance communications between all groups involved in the functioning of the school, and to streamline administration and curriculum support;
- work with parents, with other members of the local community, and with school staff to develop computer awareness and support for the use of computing in schools;
- allocate time for a teacher or teachers to co-ordinate and develop computing within the school and to manage the school's computer facilities.

Administrators and other resource managers should:

- provide teachers, principals and parents with development programs to enable them to meet the demands placed on them by increased use of computers in schools;

- give schools the means to acquire and maintain an appropriate level of hardware;
- provide resources for the development of software and curriculum materials;
- develop appropriate information processing courses for students in secondary schools;
- identify and provide curricula using computers for special groups like the disabled;
- provide schools with access to appropriate software and curriculum materials;
- provide resources to foster imaginative and effective uses of computers in schools;
- establish support and management structures for computing in schools, including appropriate information dissemination mechanisms between schools, a knowledgeable, skilled and responsive consultancy service for schools, a point of focus for liaison with groups outside their own State;
- provide enough resources to ensure that students are not disadvantaged in access to computing because of socio-economic background, race, gender or regional location.

Operational Principles Underlying the Program

The Committee has taken the Government's objectives into account in developing the principles which it believes should be followed in the introduction and administration of the Program:

- the program should be broadly based and not be limited to the provision of hardware;
- computers should be introduced and used in schools in such a way as to support greater equality of outcomes in education;
- there should be community involvement in the decision-making process, with consensus being sought regarding the allocation of resources at school, State and national level;
- in view of the different stages of development in the States, the primary responsibility for deciding on allocation of resources among the program components should rest with the respective States, systems or schools, as appropriate;
- the program should concentrate initially on secondary schools;
- no State or system should be penalised because it has allocated proportionately more of its resources towards computing in the past. However, it is expected that States and systems will provide funds at least equivalent to the funds provided through the national program;
- co-ordination mechanisms should be established at regional, State and national levels.

A broadly based program: The program should include teaching about computers and using them. An important function of schools is to help students to communicate, to think, to value and to act first and foremost as young people in school, and second in the context of the society in which they live. Today, people are using computers to control machines, to obtain and to handle information. To stay in touch with the work and leisure activities that their students will undertake, schools must give them a chance to use computers and to learn about the way other people use them. Although teachers will use the computer to enhance their students' powers of thinking and communication, they must also teach about the changes computers are bringing to all aspects of society.

The Committee believes that a broad and comprehensive general education will enable the new information technology to be shaped to the requirements of people living in a continually changing environment. This general education for all students should be seen as the first step in a lifelong educational process aimed at enabling them to take their place in the modern 'information' society and shape it to their own purposes.

Perhaps the main reason for teaching about computers is to give students greater understanding of the effects which computers and information technology may have on them in society and the means to gain greater power over their lives in a world increasingly dominated by sophisticated electronic technology. This social rationale necessitates a broad curriculum perspective. The use of computers should be seen as an integral part of the teaching and learning process. Computer technology is not regarded by the Committee as a potential replacement for teachers, nor should computer aided instruction become necessarily the focus of a school's use of computers.

The Committee believes that a broadly based program should have six elements. It recommends that funds provided through the Computer Education Program should be allocated for the following purposes:

Professional Development
Curriculum Development
Software and Courseware
Hardware
Support Services
Evaluation

Equality of outcomes: The use of computers in schools should be introduced in such a way as to foster the attainment of more equal outcomes of education. Some students need more assistance, opportunity and time than others, and resources should be distributed and approaches varied in an effort to meet their needs. In terms of this Program the allocation of resources should therefore take into account those schools and students which for a number of reasons have not yet had (or are unlikely to have without special assistance) the opportunity to participate in a well-planned and -executed computers in schools program. The Committee believes that in following this principle planning committees will need to make special provision to encourage access to the program by groups such as girls, Aboriginals, disadvantaged students and the disabled.

Devolution of responsibility for the allocation of resources: State and non-government education authorities and schools have adopted different policies and priorities in the use of computers in schools. For this reason decisions regarding the actual allocation of resources should be made at the State and sector level on the advice of representative committees for each sector.

Community involvement: The Committee believes that the effective use of computers in schools will depend in part on the degree to which parents and the community are closely involved in and informed about the changes which the use of computers will make to schooling. The Committee considers that parental involvement should not be limited to receiving information about computers, but that parents should be involved as far as possible in making decisions about the acquisition and allocation of resources. This involvement should be at the school, regional, State and national levels. The Committee believes it important that the allocation of resources among the different elements of the program in each State and sector should be made on the advice of representative committees. This matter is dealt with in Chapter 6.

Initial concentration on secondary schools: The Commonwealth Government's Guidelines to the Schools Commission for the Computer Education Program indicated that in 1984 the resources provided under the Program should be concentrated in secondary schools with planning undertaken to include primary schools later. The Committee agrees with this approach but believes it is essential that the planning necessary to introduce computers in primary schools should proceed forthwith. Because of the need for planning, the Committee believes that primary school personnel should be able to attend professional development activities funded under the Program in 1984 and, where possible, support services should be available to primary schools.

Recognition of prior effort: Some education authorities and schools have given priority to the computers in schools area and have spent funds on the provision of services and equipment. In view of the continued substantial deficiencies in provision in all States, the Committee believes that no State in respect of either government or non-government sectors should receive a reduced allocation from the total amount being made available by the Commonwealth. However, the Committee also believes that it is important that education authorities continue to provide support from their own resources for this area. A condition of funding from this program should be that the funds are provided on the understanding that education systems and schools will provide (or have provided over 1982–83) funds at least equivalent to the funds provided to them through the national program.

National and State co-ordination: This matter was also commented on in the Government's Guidelines. The Committee is firmly of the opinion that it is essential that strong co-ordination mechanisms be established at the State and national levels to ensure that the most economic and educationally effective use of resources is achieved. The Committee believes that the effectiveness of the Program can be enhanced by a degree of standardisation of equipment and materials and by the provision of support mechanisms between States and sectors. The issue of co-ordination is taken up later in the Report.

4

PROPOSALS FOR CURRICULUM DEVELOPMENT, PROFESSIONAL DEVELOPMENT AND SUPPORT SERVICES

The Committee has indicated that it believes the Computer Education Program should be broadly based and provide support for the following:

- Curriculum Development
- Professional Development
- Support Services
- Software and Courseware
- Hardware
- Evaluation.

This chapter examines the first three of these elements. Issues related to Hardware, Software and Courseware, are addressed in Chapter 5 with comments on Evaluation being made in Chapter 6.

(A) CURRICULUM DEVELOPMENT

Providing general education for all students from K to Year 12 which enables them to take advantage of information technology in a diverse and changing environment is a major challenge for those involved in curriculum development.

As society grows more dependent on high technology, the basic and essential skills required to participate fully in that society become more complex and sophisticated. Uncertainty about future life roles of students has major implications for the organisation and content of the curriculum, for teaching and learning processes and for the organisation and operation of schools. If information technology is seen merely as another 'academic' subject it will not address the experiences, needs and educational rights of young people. It must not be assumed that teachers already have the appropriate knowledge and the capacities to make that knowledge available to students. The learning experiences in computing provided by the school cannot be separated completely from the learning gained at home and in general life.

The emphasis in efforts to integrate information technology in the curriculum should be placed on developing inquiry and problem-solving skills so that students can gain an understanding of the concepts, symbolic systems and language involved. In this way information technology will not be seen as applicable exclusively to any one curriculum area, but as a tool for establishing meaning and communication, for classifying and ordering data and experiences and for opening up new approaches to learning.

Because computers can store vast amounts of information, process data accurately, reliably, at great speed and at minimal cost in human time they are a powerful means of learning. The use of computers goes beyond information management. They have the potential to assist teachers to initiate teaching styles which are more effective and more appropriate to the needs of students. They can be highly motivational. Both students and teachers are able to use computers in ways which encourage creativity, inventiveness and personal satisfaction. Computers can be used to foster inquiry, analysis, exploration, investigation and research. Ways of organising knowledge and communicating meaning can be assisted through appropriate language and graphic systems.

The primary need for all students is to acquire knowledge, to be able to make judgements on an informed basis about information technology and its interaction with and effects on society. Attitudes toward information technology will be a product of this experience.

Meeting this need requires more than introducing elementary programming, word processing and the use of drill and practice routines. Provision must be made throughout primary and secondary schooling to incorporate computing as a teaching and learning tool and to include topics about computing at appropriate levels.

For computers to become effective educational tools in learning and teaching, curriculum materials (including software and courseware) must be developed. Such materials must be able to be used by teachers and be of appropriate quality and interest to motivate the students. Regular and frequent reviews of all curricula are needed if the approach to learning content is to keep up-to-date and take advantage of the new technology.

The Committee believes that any developments in curriculum development related to the use of computers in schools should take place within and between the existing curriculum structures and agencies at the national and State levels.

The Committee believes there is an urgent need to establish formally a national mechanism for the dissemination of information about curriculum issues, which will arise from the introduction and extension of computing in schools. These activities should include a system for the evaluation of materials. The Committee believes that the reactivated Curriculum Development Centre should be closely involved in this task.

Computing in the Curriculum

Computer Awareness/Computer Literacy: Various general courses are being given or have been proposed, usually for lower secondary or upper primary students, as distinct from courses intended to be taken only by a limited group of students. These are described as 'computer awareness' or 'computer literacy' courses. There is little agreement about terminology, but in the main, 'computer awareness' suggests a need for student awareness of the nature and uses of computers and an understanding of their social effects, whereas 'computer literacy' puts greater emphasis on the functional and other skills which all people need in order to operate effectively in a society in which information technology is increasingly significant. There is obviously some overlap between the two terms, and in the rest of the Report the two are grouped together.

Eventually, as computers become widespread and are used more to help in teaching and learning in schools, the need for courses in 'computer literacy' may diminish as the objectives of such courses are achieved through effective computing experiences that the students have in their school, home and social environment. At the same time, the need for discrete courses in 'computer awareness' may also become less pressing, but elements of these may be subsumed into other subjects, such as social studies. It is unlikely that the need for awareness and literacy courses will diminish in the immediate future.

Computer awareness and computer literacy courses, should provide students with the opportunities to gain:

- an understanding of the forms of information which lend themselves to manipulation;
- an awareness of present and future applications of information technology so that they might understand the range and appropriateness of this technology in education, the home, leisure and employment;
- an awareness of when it is appropriate to use a computer system to solve a problem and when it is not;
- an understanding of the relationship between information technology and other technologies in social change in the past, present and future;
- an understanding of the social and personal implications of the widespread use of information technology. With this knowledge students should be able to understand and hence to exercise greater control over the effects of information technology on their lives;
- an awareness of the fact that it is people who give computer instruction and enter the text or data;
- an understanding of the meaning and interpretation of common technical words and phrases associated with information technology;
- an appreciation of the relationship of the students' own knowledge about information technology to decisions they make about their career and life objectives;
- confidence that they can control the computer and communicate with it, to their advantage, in a variety of situations;
- an awareness that those who design and implement computer applications have a moral and ethical responsibility to the community.

Computer Studies and Information Processing: This area covers more specialised and academic courses in computing. It is seen as an elective component of growing importance in the curriculum. Computer Studies and Information Processing as an area of study is most often placed in the later years of secondary school. It need not be confined to this level.

In this area students should be given the opportunity to:

- develop an approach to problem solving which complements problem solving in non-computer areas and promotes good design and practice techniques;
- develop an understanding of the concepts and techniques that apply to computer programming in the broad sense. The emphasis should be on structures and processes. Study of a particular high level programming language should be in the context of using that language as a vehicle for the more important matter of problem solving;
- gain practical experience in design and construction of algorithms and some experience in implementing these algorithms in a suitable high-level language;
- develop an awareness of the different components and functions of typical computing systems (both hardware and software) and an understanding that they are part of a larger system involving people;
- gain a knowledge of of information processing applications and techniques, using software packages such as word processing, database management systems and other information handling systems;
- develop an understanding of the social implications of information technology;
- develop an ability to identify present and potential uses of information technology systems in society.

Separate courses are required for Computer Studies and Information Processing as the content, concepts and skills cannot be appropriately covered within existing subjects such as mathematics and science. Girls should be actively encouraged to study in this field. This may well require positive action to encourage their participation and the development of a curriculum which is gender inclusive.

Computer Electronics Courses (where they exist) are usually an elective component in secondary level technical studies or physics courses specifically about computer construction and maintenance. They can be a valuable adjunct to pre-vocational courses in secondary schools.

Using Computing Across the Curriculum: Computers should be used in areas of the curriculum where they can be more effective than other methods of teaching and learning. They are particularly relevant in the business studies and accounting area, typing and general secretarial studies. Other areas are only beginning to be transformed, such as industrial arts, music and languages. It is important that girls and boys acquire computer skills in these areas so that they can keep in touch with changes already occurring in the wider community.

Computers can create new learning environments. For example, the use of simulation techniques allows students to explore processes that would otherwise be denied to them because of the expense associated with specific equipment changes, long- or short-time scales, etc. Students should be introduced to learning experiences at the school in those areas where computers are being used in society.

A uniform computer based approach to learning is neither appropriate nor desired. Learning should be centred on the topic, not the tool. The use of computers will differ widely, reflecting the range of purposes and kind of classroom situations. A diversity of learning styles suited to particular students should be accepted as an essential aspect of learning. Thus, the use of computers in a classroom situation should be well integrated with other learning activities.

In the area of teaching and learning with computers a variety of terms are used. The three most commonly accepted terms are Computer Assisted Instruction (CAI), Computer Managed Learning (CML) and Computer Assisted Learning (CAL). The last is the most generic and inclusive term.

Computer Assisted Instruction (CAI) is a form of computerised programmed learning. The computer acts as a tutor teaching new concepts or in such a manner as to give the learner individualised practice in concepts or skills already introduced by other teaching methods. A good deal of the software now available in schools is of the CAI drill and practice type.

In Computer Managed Learning (CML) the role of the computer is to assist the teacher in managing the learning process. It includes such uses as test construction and scoring, records management and the progression of students through courses. Its effective use in schools requires research and development work and the provision of suitable software.

Computer Assisted Learning (CAL) or, as some call it, Computer Based Learning (CBL), places greater emphasis on activities initiated by the learner. In addition to the tutor and exerciser roles of CAI, CAL also provides opportunities to acquire new knowledge and skills through simulations, information handling, problem solving, data analysis and the use of the computer as a calculator.

The following are among the more common applications presently in use in schools:

drill and practice
tutorial
simulation and modelling
problem solving
educational games
information handling
word processing
spreadsheet
graphics
electronic blackboard.

In applying the computer across the curriculum, students should have the opportunity to:

- acquire appropriate and relevant experience of Computer Assisted Learning materials where applicable;
- use the computer as a tool for specific purposes, such as word processing, information handling;
- use the computer as an aid to problem solving.

Computer education within schools should develop as part of a broad and comprehensive general education, rather than as a narrow vocational or specialist area of the curriculum.

Special Education and Information Technology: Disabled students need extra help with learning. Their capabilities for learning vary greatly. The computer is a potentially powerful tool to meet their special needs. It is important that software be designed not only for ordinary students, but with the disabled in mind. Computers can greatly enhance the integration of some disabled students into regular schools.

Some advantages of the use of information technology for children with special needs, such as the disabled, are:

- its ability and power to provide software which will extend the special education curriculum to include skills not currently being taught, e.g. information handling;
- its capability to address the visual, auditory and tactile senses and its adaptability which allows it to overcome some physical handicaps;
- its motivating features and patience;
- the possibility it provides for working independently.

Information Technology and the needs of disadvantaged groups: A distinction should be made between disadvantages due to lack of access to computer facilities and disadvantages due to the nature of curriculum materials and software. Many of the groups seen as disadvantaged suffer primarily from a lack of access to computer facilities. Inequality of access should be addressed as a matter of urgency.

The Committee believes that special provision must be made for curricula which specifically address the needs of girls, students living in remote and isolated areas, Aboriginal students and those coming from other racial and ethnic minorities, students who are socio-econonically disadvantaged and disabled students. The special provision may include specialised software and courseware and specialised support staff. It is also important that attention should be given to appropriate teaching methodologies and methods of school organisation which take into account the different needs and aspirations of students in these groups. The Committee is of the opinion that not enough is known about how the use of computers affects the learning environments of particular groups and believes that studies should be undertaken to investigate and report on this matter.

In the development of curriculum materials and processes care should be taken to ensure that the greatest opportunity is provided for students to succeed. In this regard, encouragement should be given to co-operative group learning practices as distinct from individualised competitive learning ones. There is a need to ensure, in the development of curriculum, that assessment and credentialling procedures are consistent with the objective of full participation in the program by all groups.

The computer can have a subtle, but very important influence on the degree to which students are motivated to participate, and further investigation is needed of the effects of computers on the learning environments of particular groups.

Successful curriculum development in school computing will depend on close links being established and maintained between curriculum developers, computing professionals, in-service educators, support staff, practising teachers and program evaluators.

Curriculum Support

Curriculum support applications include all those school functions that are used to support classroom activities. The processing of information related to the school timetable, and the management of the school resource centre (library and audio-visual material) are presently the two main areas of use. Other uses, however, are available and will further develop in time:

- information retrieval systems where, for example, a teacher preparing lessons on a subject could, via the computer, obtain a bibliography of all available references on the topic, sort out the most relevant, print out the 'abstracts' for these, and, perhaps place a library order for the required references;

- personal/professional database and information retrieval system for managing the teacher's professional documents including lecture notes, curriculum materials and audio-visual aids;
- linked word processor/graphics/mathematics system for preparation of the 'hard copy' requirements of the teacher, be they class notes or 'exercises', work programs, research papers or other letters or reports;
- tests which can readily be presented, corrected and analysed via a computer, to assist the teacher in the diagnosis of learning problems;
- 'mark-book' maintenance, which can assist the teacher maintain comprehensive records on students' progress, undertake detailed evaluation of a child's developmental strengths and weaknesses and provide comprehensive information on children's educational needs and progress.

Communications/Information Exchange

The continued development of Australian and overseas computer networks will allow schools interactive or two-way access via telephone lines or communications satellite, to information in central data exchanges. Information available in this way could include:

- school library cataloguing information services;
- community resource files, for example listings of resource people or potential school excursions;
- curriculum information and data services;
- careers information;
- software information and distribution services;
- information about commercially available, system produced and teacher made resources;
- 'bulletin board' or electronic mail services.

The computer may also be used to share resources between schools in an area, for example through listings of periodical holdings, videos, educational packages and other valuable materials.

Administrative Applications

Administrative applications are distinct from the curriculum support applications in that access to them is generally restricted to the school executive and administrative staff. They include school accounting, stock records etc. In this area, it is likely that the methods and techniques used will continue to be borrowed from the business world. In addition, computer data base facilities can be used for activities such as:

- student registration details (including personal details such as next-of-kin, doctor, allergies etc);
- statistics required for special grants programs (e.g. for migrant and multicultural education grants, disadvantaged schools projects).

Recreational Computing

Australians have an increasing amount of time available for recreational activities and the computer will be an important feature of these. Such activities will not simply consist of reflex video games of the Space Invaders type. Computers have the potential to provide a wide range of intellectually stimulating and challenging 'games' for all ages, ranging from chess, to extremely sophisticated 'adventure games' which require skills in reading, comprehension, decision making, spelling, grammar and logic. Programming a computer also can be an intellectually rewarding, and time consuming, recreational activity.

Recommendations

It is recommended that:

(1) Curriculum development activity take place within and between the existing curriculum development structures and agencies at the national and State levels.
(2) Immediate support be given to the establishment of a national mechanism for the dissemination of information about curriculum issues (including evaluation) which arise from the introduction and extension of computing in schools and that the reactivated Curriculum Development Centre be closely involved in this task.
(3) The first priority for curriculum development be the provision of computer awareness and computer literacy experiences for all students in the years of compulsory secondary schooling.
(4) A second priority is to promote the integration of computing into the school curriculum, in primary as well as secondary schooling.
(5) A third priority is the provision of optional computer studies courses at the secondary level, to allow studies at some depth.
(6) Special consideration in funding be given to the development and implementation of curricula for girls, students living in isolated areas, Aboriginal students and those coming from other racial and ethnic minorities, students who are socio-economically disadvantaged and disabled students.
(7) Funds be made available to investigate the effects of computers on the learning environments of particular groups of students.
(8) Encouragement be given to the development of curriculum materials and processes which provide greatest opportunities for learners' success, and for co-operative group learning as distinct from individualised competitive learning.

(B) PROFESSIONAL DEVELOPMENT

The Committee believes that the ultimate success of the Computer Education Program depends to a large degree on the ability of education authorities and schools to plan and implement a successful Professional Development program associated with the use of computers in schools.

It is recognised that parents will play a vital role in any national program, as participants in school decision making process and in their children's education. This group must be informed of, and included in, each aspect of the development and implementation of computing in schools.

In planning a professional development program a wide range of skills and knowledge will need to be encouraged, as will the involvement of teachers with a variety of backgrounds, including women and non-mathematics and non-science teachers. Skills will vary depending on the work which the teachers need to undertake. A list of objectives for various target groups is contained in Appendix D of this Report. The list was prepared by the Committee's Professional Development Technical Working Party. The Committee believes that in the planning of any professional development scheme the central role of the school principal should be recognised and reinforced.

The task facing educators in the Professional Development area is a major one. Overseas and Australian experience has shown that unless members of school communities have a sound background knowledge and a reasonable level of skill in the use of computers, the effect of the introduction of computers into schools can be limited and in some cases counter-productive. The Committee believes that every effort should be made to identify, to make known and to support persons who are able and are willing to provide leadership in computing in schools. These people should be assisted to keep in touch with world-wide developments and to set up among themselves a mutual support and information network for the benefit of schools and systems.

While professional development activities for personnel working in and connected with schools are vital, it is also essential that beginning teachers are equipped with the necessary skills and knowledge in the schools computing area. Tertiary institutions engaged in the pre-service education of teachers should include in the courses of all students, studies of the application of computers to education. The Commonwealth Schools Commission should discuss with the Tertiary Education Commission ways in which this could be achieved over the next Triennium.

In providing professional development activities there is a range of approaches which might be used. The Committee has considered the following:

- Central short or long courses
- Consultancy teams
- Development of school networks
- Action Research
- AV tutorials
- TV courses in and out of school time
- Regional, State and national computer conferences.

If a large number of teachers is to be trained with limited funds then the traditional method of providing a variety of short and long courses would appear to be among the most cost effective. The Committee would define a short course as one which runs between one and five days. These courses will enable teachers to gain some understanding of the technology and of the most effective ways of using software in the classroom.

Some examples of areas in which short courses may be held are:

- an introduction to the use of microcomputers;
- aims and objectives of computer literacy;
- how to use packaged software in the classroom;
- girls and computing;
- the evaluation of software;
- subject-based courses, e.g. Business Studies and Technology.

Long courses may be offered by Education Department computing centres, by Tertiary Institutions, by regional consultants or by other persons who move regularly to a particular site to conduct a course. It is stressed that these courses should be geared to education and not just programming courses. Examples of such courses are:

- courses for computer literacy teachers;
- courses for computer resource teachers;
- courses for business studies teachers;
- courses for teachers who may have formal computing qualifications but need training in consultant skills;
- courses for key software designers.

Another approach which should be supported is the establishment of consultancy teams as part of system support services. Such teams would carry out the following types of activity:

- initiate and assist in the planning and execution of lessons with teachers in their own classes in a team teaching context;
- conduct staff seminars and support school based curriculum development or adaptation;
- confer with in-school administrators to plan computer education activities and identify scheduling implications;
- participate in parent group activities related to computing.

In each school where programs operate, one or more teachers should undertake appropriate training to enable them to become resource persons for the school as a whole in the educational use of computers. Such computing resource teachers would carry out the following responsibilities:

- Co-ordinating and managing the deployment and school use of computing resources;
- Assisting with school based curriculum development; with particular emphasis on developing an environment in which all teachers and students including girls and women and those not involved in mathematics and science subjects, feel confident to participate in computing activities;
- Assisting with and leading staff development activities as appropriate;
- Providing advice to the school on issues relating to computing;
- Acting as liaison officer between the school and other schools, regions, and central authorities in relation to computer education policies and practices;
- Disseminating information on computing within and beyond the school;
- Liaising with teacher-librarians and other school staff in the acquisition and evaluation of software and other matters;
- Assisting with the development and maintenance of administrative systems and other information networking applications;
- Supervising and undertaking appropriate hardware and software maintenance.

The development of school networks is a mechanism aimed at developing resources at the regional, State and National level which build up a level of expertise and thus allow individual schools to provide support to others. Such a system would:

- provide a network of schools across the country able to provide professional development for teachers in the use of awareness of computers;
- provide a flexible system of professional development which is able to meet the particular local needs of each educational region or State;
- provide a mechanism by which it is possible to couple the delivery of hardware and software to schools with the professional development of teachers;
- provide a means by which schools and teachers who have already developed their expertise and capability in the area of computer education are able to be recognised, utilised and supported.

Action Research is an activity which may be appropriate in some circumstances. It is a structural approach to innovation which allows participants to examine their own practice and suggests directions for improvement by establishing a recurring cycle of planning, action, observation and reflection.

Tutorials and TV courses: The most successful approach to professional development occurs when teachers and competent computer educators can work together. Advice from consultants will be required in the specific area of teaching about computing and in the much broader area of the use of computing in the total curriculum. There is a very limited number of competent, experienced computer educators in Australia who could undertake a consultant role in schools. To facilitate the application of computing across the curriculum, the expertise of the computer consultants will need to be used for consultants' in-service in all curriculum areas. By itself, this will not be enough and hence it will be necessary to develop and facilitate the use of audio-visual and computer assisted teacher development packages as components of a professional development program.

National and State level conferences are a major mechanism for teachers with some experience of computing in schools to share their experience and improve their knowledge and to draw together the results of action research projects. These conferences require funding support for organisation and to encourage participation. Various subject associations sponsor conferences at the State and national level. The Committee would encourage these Associations to allocate a segment of conference programs to the applications of computer use in their subject area.

Community Expectations and Awareness

It is unrealistic to expect that the amount of funding available initially for the Computer Education Program will enable all schools to make dramatic improvements in use of information technology in general and computing in particular. At the same time, it is recognised that technology and computing are highly visible areas in society and are likely to remain so in the immediate future. As such, computing in schools will have a large degree of attention focussed on it. Public perception of the situation will largely be dependent on media reports, especially in the absence of dissemination of program information in the community through the school and system. It is important that attainable goals be set at the school level and that the local school community be involved in the setting of these goals so that realistic expectations are developed.

Given the normal rate of curriculum development and the cost and factors associated with professional development, it is certain that the more advanced information technology applications in society will continue to outstrip that which schools can offer. There are a number of ways of minimising the difficulties that could arise from this situation:

- a higher level of communication between the school, its parent community and the business community;
- increased liaison with the media, to encourage reporting of a balanced view of what schools are doing, on a regular basis rather than that prompted by anomalies;
- increased use of public affairs programs and other broadcasts to inform people of what is happening in schools in this area;
- increased support for activities like Information Technology Week;

- investigation of ways of achieving constructive feedback to schools from the community;
- increased co-operation between Departments of Education and those associated with Science and Technology development.

Recommendations

It is recommended that:

(1) In 1984 Professional Development activities in the computers in schools area be given high priority in the allocation of funds from the Computer Education Program and from the Commonwealth's Professional Development Program.
(2) Delivery mechanisms developed by States and systems should pay particular attention to the full participation of women teachers, non-mathematics and -science teachers and disadvantaged groups amongst teachers. It may be necessary to provide special courses for these groups.
(3) Participation of men and women in Professional Development activities reflect their proportion in the teaching service on a State-by-State basis.
(4) In the implementation of delivery systems for professional development, existing structures be used and further developed.
(5) In implementing the Professional Development component of the program, States and Systems choose from a selection of alternatives. Among the options available are long and short courses, the establishment of mobile consultancy teams, school networks, action research, audio-visual tutorials, television courses in and out of school time and regional, State and national conferences.
(6) In any projected Professional Development schemes the central role of the school principal be recognised and reinforced.
(7) Tertiary Institutions engaged in the pre-service education of teachers include in the courses of all students, studies of the application of computers to education. It is recommended that the Commonwealth Schools Commission discuss with the Tertiary Education Commission ways in which this could be achieved over the next Triennium.
(8) Efforts be made to identify, to make known and to support persons who are able to and are prepared to provide leadership in schools computing. These people should be assisted to keep in touch with worldwide developments and to set up among themselves a mutual support and information network for the benefit of schools and systems.
(9) Teacher Associations in all subject areas be encouraged to allocate a segment of their conference programs to the applications of computer use in their subject areas.

(C) SUPPORT SERVICES

If the objectives of the national program are to be achieved, support services will be necessary. There are needs at the level of the school which include the whole school community of teachers, parents and students. Parents are able to contribute, through parent groups and school councils, to the formulation of school policies on computers, and have skills to offer. They also have a need to understand and support the learning practices of their children if a gap between students and parents is to be reduced. They have a need for knowledge and understanding of computing in schools if they are to participate effectively in school decision making. Support services therefore should address the needs of teachers but should not be limited to them. Planning, policy development, direction setting and leadership are significant and essential functions of a complete support service. While some of this support should be available within larger schools, much could not be provided on an individual school basis.

Teachers will require services which include access to appropriate hardware, software, curriculum materials and sound advice on how to use these resources. Access to technical support and information is necessary for decisions to be made with respect to initial purchase of hardware and software, its suitability and supportability, fault finding, diagnosis and maintenance options, upgrade options, and trends in developments in hardware and software. Information covering security, wiring and ergonomic considerations needs to be readily accessible before purchase and installation decisions are to be made.

Advice based on educational experience and understanding should complement that based on technical knowledge. Such advice includes support and encouragement for teachers to develop appropriate classroom management techniques that will facilitate effective use of computer technology as an educational resource. Access to balanced information can counter commercial and community pressures which are always present in new and expanding areas of development, but not always based on educational considerations.

Teachers must be supported with information, and helped to develop the expertise to enable them to select software of an acceptable standard which is appropriate for their needs.

While curriculum development should occur at the classroom or school level so that individual needs are met, such development is frequently most effective and efficient when available materials are used or adapted for use. School based curriculum development is important but should be placed in the context of the full range of curriculum developments. It is recognised that teacher developed materials are often of high quality and there should be a structure through which such materials are packaged, promoted and provided with continuing support.

Current information on curriculum development, the use of technological developments and methodology in other systems and schools and the work of others can provide support and stimulus to teachers. Various means of exchanging this information should be facilitated. Opportunities to discuss innovative ideas should be provided for teachers, together with the necessary resources needed to translate these ideas into materials for themselves and other schools.

Information from curriculum groups, subject associations, interested groups and tertiary institutions, should be readily available to teachers, parents and the community.

Support is also required for classroom management, school administration and the organisation of curriculum in schools.

The provision of support services for computing activities must take heed of the following:

- The existing range of teachers' expertise. Some teachers have a broadly based expertise in the use of computing in schools. Many have started to acquire some skills and

knowledge related to their area of teaching. Some have a basic awareness of the potential of computing in schools while a majority must be regarded as generally uninformed.
- The wide range of subject specific requirements, e.g. the support needed by matriculation level Computer Studies teachers is markedly different from that needed to introduce the use of the computer as an aid to written composition in primary schools.
- The skills, knowledge and attitudinal changes that may be needed by all teachers, based on the assumption that the real growth in computer usage will come from the use of computers as tools.
- The needs of parents and others, as well as teachers and teacher aides, for support services.
- The mystique of computing which often creates considerable apprehension among many people.

Implementation Strategies: The needs of schools and teachers in support of the teaching about and use of computing can be classified in various ways, for example according to the kind of service required; the level (geographically and organisationally) at which these needs may best be met; the kind of mechanism most appropriate to provide the services; the area of the curriculum involved; or the degree of urgency attached to the need.

Support services may be provided at several different levels:

- within a school;
- for a cluster of schools in a country or metropolitan area;
- for a region (such as an administrative or major geographic region in an education system);
- for a whole system, or for a State (if both government and non-government schools agree to be jointly supported).

A further possibility is for support services to be provided at a national level. The Committee recognises the need for national co-operation and co-ordination but believes that this need will probably best be met by co-operation and linkages between groups at system or State level, possibly under the auspices of the Commission's Program.

Several different strategies or mechanisms exist for support of computing in schools including:

- the fostering of a supportive organisational climate within schools;
- the planning and implementation of pilot projects;
- the provision of a consultancy and advisory service;
- the establishment or recognition of an organisational structure which facilitates the operation of support services; including support centres;
- a teacher development program;
- a community awareness program.

Fostering of a supportive organisational climate within schools: The existence of a supportive climate is an important element. Both systems and school administrators need to be informed about computers and their educational implications and sympathetic to the aims of educational programs and the activities which support them. Clear policies and guidelines on computers in schools, flexible approaches to staffing and funding (for relief, positions of responsibility, key-teacher appointments etc.) support for professional development (from visits to other schools to whole-school professional development activities) and action research projects can all be of great value. Within individual schools, especially if there are few or no staff experienced with computers, access to grants and release time for activities within schools, or within and between a cluster of schools, can be helpful.

Planning and implementation of pilot projects: These may be of various kinds involving issues such as networking, co-operative sharing of facilities between schools, and the trialling of software packages.

Provision of consultancy and advisory services: Both advice and in-service activities should be responsive to developing needs and should provide support for the integration and use of computers as an aid to learning in all aspects of the primary and secondary curriculum. It is essential for schools to have access to consultants or advisors who understand their needs and have an appreciation of central policy. It is recognised that interpersonal skills, consultancy skills and the ability to facilitate change are of prime importance.

Establishment of an organisational structure: As already noted, most government school systems in Australia have found great benefit from setting up centres or units specifically to provide support at State or local level for some or all aspects of computer education. In addition, existing specialised services (for example, those concerned with special education) may provide support in computing in their own areas of responsibility. Further, other mechanisms could be and are being used, such as Education Centres (funded through the Commission's Program), other Teachers' Centres, existing or new subject associations.

Support centres: A support centre may be identified as:

- A unit operated by a State to provide State-wide services, such as computing power, networking, curriculum advice, training, software and courseware.
- A unit in a school which provides services to schools in the adjacent area, as well as to its own students.
- A regional advisory unit, supported by a State authority, to provide services (or assist in their provision) within that region.
- A unit set up specifically to design courseware, software or hardware for school use, but having no direct contact with schools in the provision of computing power or materials.
- A unit within a school of teacher education, intended to facilitate professional development in a laboratory environment.
- Support provided by a professional association or a teachers' centre.

The provision of support services for computing in schools is a matter of considerable complexity, in that:

- activities and support must be related to existing programs, structures and funding mechanisms at national, State and local levels;
- computers in schools relate to all aspects of the curriculum, and to all levels of schooling; consequently, activities in relation to computers are far from self-contained;
- account must be taken of the very great variety of schools and their needs, including differences according to geographic location, degree of isolation, socio-economic status, migrant and non-English-speaking density, and also the variation in the level of experience of staff (and students) in the use of computers.

There are therefore substantial needs for co-ordination and communication including the co-ordination of budget and resource allocations.

Recommendations

It is recommended that:

(1) States be encouraged to commit some of the Program funds allocated to them to hardware and system software in support centres.

(2) The feasibility of joint access to support centres for both government and non-government schools in each State or region be explored.

(3) Discussion be initiated with the Commonwealth Tertiary Education Commission to identify tertiary institutions with access to appropriate expertise. Consideration should be given to funding a support facility in each institution which will increase the number of teachers with substantial expertise in computing topics including, if possible, a study of computer science.

(4) As the provision of co-ordinated Support Services is best made through the establishment or further development of comprehensive centres or units in each State or Territory, funds be used to supplement the recurrent costs associated with the establishment or expansion of such centres or units.

(5) The guidelines associated with funding for centres and units allow for operational costs of regional and district facilities.

(6) Provision be made to allow for the flexible use of funds consistent with the functions and services described in this Report.

(7) A National Computing Network based on these centres be established progressively to support the co-operative and integrated nature of the national program.

(8) Consistent with the maintenance of effort within each State and Territory, funds from the national program be made available for the training and associated operational costs of consultants and also for the employment of additional consultants.

(9) Special measures be taken to appoint qualified women within the support structures for computing in schools. This may require the development of employment and training policies to increase the number of women with suitable qualifications and/or teaching experience.

(10) The importance of supporting teachers in schools, not only through the services described, but also by encouraging initiative at the school level and facilitating the sharing of such developments and information through the centres and units be recognised. Small grants should therefore be made available for the support of innovative practice in schools.

5

PROPOSALS FOR SOFTWARE/COURSEWARE AND HARDWARE PROVISION

(A) SOFTWARE AND COURSEWARE

Software is the term used to describe the sets of instructions (programs) that control and direct computer hardware. Courseware is the term used to describe a curriculum package that may include software, documentation, audio-visual and other material such as students' activity sheets.

Although there are extensive catalogues of software available for most of the computers in use in schools, what is lacking in all areas of the curriculum is a wide range of quality courseware. The problem is compounded by the fact that the majority of software that is available can only be used on particular types of computer hardware. Recognising the need to make the most effective use of resources that are likely to be available in the near future, emphasis should be placed on providing software and courseware that will:

- enable students to use the computer as a tool for inquiry, analysis, information storage, retrieval and processing, written expression, creativity, problem solving and recreation;
- assist students to understand the variety of applications of computing;
- enable students to acquire skills which have vocational implications, e.g. word processing;
- give teachers opportunities to develop techniques of using computing as a teaching and learning tool;
- give teachers access to word processing, database management packages and graphics manipulation facilities;
- assist schools to use computing for administrative and curriculum support applications;
- assist school systems to foster effective and imaginative use of computing;
- facilitate appropriate involvement of teachers in effective software/courseware development;
- be free of sex role stereotyping, racial or social bias.

It is recognised that software/courseware that is purchased from Program funds must serve the objectives determined for curriculum development and should work with no modification for at least one of the recommended computer systems.

Categories of Software and Courseware: There are several basic categories of software:

- Operating systems which are instructions that allow the various components of the computer hardware to work together and to use software. Operating systems are frequently specific to particular brands of computers and are generally supplied by the computer manufacturer.
- Utilities software which provides the computer user with a set of tools that assist in the management of computing systems including tasks such as copying disks, diagnosing hardware and software problems.
- Subject specific courseware which includes the bulk of what would generally be recognised as educational courseware, for example programs written for simulation, tutorials, drill and practice.
- General purpose software which provides the general user with a set of tools for word processing, database manipulation, electronic spreadsheet, data reduction, graphics manipulation etc. It is this category which is seen as having widespread applicability in all aspects of the curriculum.
- High level computer programming languages.

In the long term the selection of operating systems and system utilities should result from the educational user and technical requirements developed as part of the process recommended by the Committee in relation to the hardware acquisition process (see Appendix E).

The Committee believes that general purpose software for word processing, spreadsheet, database and data reduction should be available for the recommended hardware. The Committee also believes that it is important for schools to have access to a minimum set of utilities and exemplar software.

Access to Software/Courseware: Software/Courseware is being developed by educational authorities, commercial software houses, publishers, computer user groups, subject associations, tertiary institutions, schools and individual teachers. Little national co-ordination has so far been achieved in the acquisition and sharing of software between schools and systems. The Committee believes there is a need to establish effective mechanisms that allow for better access to software and courseware. The development of such mechanisms is an urgent task and one which should be taken up by the Curriculum Development Centre.

Software/Courseware Development and Dissemination

The value of teacher involvement in the design and development of software and courseware is fully recognised. The involvement of individuals will vary depending on the intended users. Generally, the Committee favours using a team approach with the teachers, programmers and other qualified personnel to produce software and courseware for widespread use. So that this process can be carried out effectively it is important that software development aids be available to assist teachers to develop and modify software and courseware for their own use. The Committee believes that a good deal of this software/courseware development could be carried on in the support centres referred to earlier.

The Committee considered a variety of techniques for the dissemination of software/courseware and information, both in the short and longer term. In the short term the committee supports the use of such mechanisms as:

- software distributed on floppy disk;
- courseware disseminated using postal services;
- the adoption and use of a standard software review sheet to develop an information database for software and courseware.

Information disseminated through support services using printed materials such as microfiche is an additional option.

In the longer term the Committee believes that educational benefits and a good deal of cost effectiveness can be gained by software and information dissemination being undertaken by telecommunications. In the first instance such dissemination techniques should be trialled at a State level with a view to possible expansion into a national network. It is considered that support should be given for mechanisms which facilitate the exchange of software produced by teachers.

Computer Programming Languages

At the secondary level, the most commonly used computer programming language is BASIC. There is, however, increasing interest in the use of LOGO at the junior secondary and primary levels. Pascal is also used in senior secondary school computing courses. The Committee believes that it is important to make recommendations regarding the computer programming languages to be used in schools. In its recommendations it is indicating both a short- and long-term approach.

It is considered that software/courseware design and development will be improved if a document covering design methodology, design specifications, programming, coding and packaging is available. The Software and Courseware Technical Working Party has prepared draft documents and the Committee believes that action should be taken to develop them further using, if possible, the services of the Curriculum Development Centre.

Recommendations

It is recommended that:

(1) General purpose software for word processing, spreadsheet, database and statistics/data reduction be available from program funds for the recommended hardware.
(2) As a matter or urgency the Commonwealth Schools Commission establish mechanisms to:
  (i) provide for the acquisition adaptation or development of general purpose and subject specific software and courseware;
  (ii) allow for appropriate marketing procedures;
  (iii) assess the continuing software and courseware needs of schools.
(3) In establishing these mechanisms the Commission work closely with the Curriculum Development Centre in providing appropriate support and implementation structures.

(4) The mechanisms referred to above be funded initially by the Commonwealth but should aim to generate adequate income to become self-sufficient in the longer term.

(5) Software/courseware intended for widespread use be developed using a team approach with the team consisting of teachers, programmers and other qualified personnel as required.

(6) Software development aids be available to assist teachers to develop software/courseware for their own use, e.g. graphics tablets, light pens, language compilers, programming standards.

(7) Development work be carried out in centralised computer centres where appropriate.

(8) With regard to computer programming languages, in the short-term the following be supported:
  (i) for students, at least LOGO, Pascal and BASIC available for the supported hardware;
  (ii) for software production, the versions of BASIC available for the supported hardware, LOGO, Pascal and hardware dependent machine code where appropriate.

(9) In the longer-term:
  (i) the set of languages for student use be reviewed regularly;
  (ii) the feasibility of an interpreter/compiler for a single dialect of a language suitable for software development on all supported hardware systems be investigated;
  (iii) a study be undertaken to investigate the use of fourth and later generation languages.

(10) The national program only support software and courseware that meets valid educational needs and is free of sex role stereotyping, racial or social bias and which facilitates progress to more equal educational outcomes.

(11) The draft document covering design methodology, design specifications, programming, coding and packaging be completed to a stage where it is suitable for publishing and when published, the document should be made available as a guide to teachers and other software and courseware developers. It should be the subject of further development by the Commission.

(B) HARDWARE

Although computers have been used in some Australian schools for more than a decade, it is only in the last three or four years that the development of low cost microcomputer hardware has made it possible for there to be widespread school and personal ownership of computer hardware. The widespread availability of a variety of hardware has opened up opportunities for school use of computing that have not previously existed, but at the same time it has caused a number of problems.

Major areas of concern include the diversity of incompatible equipment and software, and consequent problems for professional development and the provision of services. The Committee is of the view that to alleviate these diseconomies and difficulties it is necessary to adopt a short-term policy aimed at encouraging a limiting of proliferation of purchase of computer types, whilst addressing the issues of curriculum and professional development. Further, the Committee believes that there is a need to implement a long-term program to achieve economic use of resources and standardisation of equipment and at the same time facilitate co-ordination at all levels through the appropriate use of support centres and telecommunications.

Hardware Development: To meet the long-term requirements of schools computing activities in Australia, it is considered essential to embark on a national research and development project that will ensure that appropriate computer systems are available. This, as outlined in more detail in Appendix E, will involve:

- the research and preparation of a set of Educational User Requirements. This is a statement of agreed educational needs to be met by the computer systems;
- the development of a set of Educational Technical Requirements based on the Educational User Requirements. This is a statement of the function, main features and performance required by the user for a system which can reasonably be expected to be available to satisfy the requirements in the planned time period;
- a System Concept Study which involves research and analysis of all practical alternatives to satisfy the Educational Technical Requirements. It includes consideration of development and production options and use of existing items either as they are or in modified form;
- if no existing items satisfy the Educational Technical Requirements, then a development proposal leading to the design and development of appropriate systems is required.

The Committee believes that the proposed National Co-ordinating Committee using funds provided to the Commission for research and development should prepare, as a matter of urgency, Educational User Requirements and Educational Technical Requirements for computer systems for use in secondary schools, primary schools and support centres. The Committee also believes that the Department of Science and Technology should be involved in all stages of this process and that it should give urgent consideration to seek funding for the computer system research and development in the public interest.

Interim Support for Microcomputers: It is recognised that in addition to the adoption of a strategy to deal with long-term computer hardware issues, support must be provided for existing hardware in schools. Two kinds of support have been identified for microcomputers in secondary schools. The first type is for activities and may include the provision of software, courseware, professional development and the maintenance of the existing hardware and software. A second type is financial assistance in the acquisition of microcomputers for schools. It is believed that the latter should only be made available if the following guidelines are adopted:

- applicant schools have developed an appropriate curriculum and professional development plan demonstrating that the equipment will be used effectively;
- computer systems purchased are in the early stage of their life-cycle. In this sense, purchases of computers which are near the end of their product lifetime should be restricted to those cases where the argument for compatibility outweighs this consideration.

The Committee received advice from its Hardware Technical Working Party on the issue of interim support for microcomputers. The Working Party indicated that should a decision be taken to allow the purchase of hardware from Program funds, the support for this element should not be large and should be provided within strict guidelines. The Committee is of the opinion that computer hardware should be able to be purchased with program funds in 1984. It also believes that a substantial level of standardisation of equipment is necessary if a balanced and effective national Computer

Education Program is to be implemented. This point of view is consistent with the Government's Guidelines to the Schools Commission which request it to have regard to the economic use of resources including the standardisation of equipment and materials.

The Committee requested the Hardware Technical Working Party to recommend a small number of systems which might, as an interim step, be supported by the Program. The Working Party recommended the following microcomputers:

BBC Acorn (with or without Z-80 and CP/M Support)
Microbee 64
Apple II/IIE

The recommendation to restrict hardware purchases to these three microcomputers was based upon the considerations which led to their nomination by several State Education Departments following a rigorous tendering process. These considerations include cost, degree of use in schools throughout Australia, capacity to support a sufficiently wide range of computing activities in schools, software availability, ease of use, and support which is currently available from systems. The Committee has accepted the advice of its Hardware Technical Working Party and recommends that as an interim measure, for at least the first two years of the program, Commonwealth funds be restricted to the purchase of the three designated machines. The Committee wishes to emphasise that it sees this decision as an interim one pending the development of the user requirement document by the proposed National Co-ordinating Committee as set out above and in Appendix E.

The Committee is aware that it has not made a specific recommendation regarding the lower level hardware currently in use in many schools. It has declined to do this based on the advice of its Hardware Working Party and a consideration of the curriculum objectives. It believes that it is better to concentrate Commonwealth funds on more powerful and more versatile machines, and sees no reason why, within reasonable time, these should not be available at reasonable cost to all schools. Nevertheless, the Committee wishes to acknowledge that many schools, for a variety of reasons, may wish to purchase these less powerful machines from their own resources. To prevent further proliferation in the variety of this type of equipment, the Committee is of the opinion that schools in this position should follow the relevant recommendations of the respective State Departmental Committees.

While it is recommending that there be a limitation on the range of hardware that can be purchased with Program funds, the Committee believes that this restriction should apply to the purchase of hardware (and associated maintenance) and software design and production for the nominated machines. Professional Development and consultancy support activities linked to other machines and equipment should be eligible for support.

In the short-term, support for the purchase of hardware should constitute a minor part of the overall funding of the Program and the guidelines outlined on page 44 should be adopted in the funding of school level installations.

In providing support to schools for the purchase of computer hardware the Committee believes priority should be given to schools participating in the Disadvantaged Schools Program which presently do not have these resources, and to schools serving similar needy communities.

The Committee believes that the list of microcomputers to be supported under the Program should be regularly reviewed in the light of changes in technology and schools' needs and believes that this function should be undertaken by the proposed National Co-ordinating Committee. The Committee believes it important to indicate its belief that the rapid developments in computer technology mean that there will be relatively frequent need to replace some equipment used by schools. Any future planning should take into account this recurring requirement for funds.

Telecommunications System Networking: There is evidence to suggest that the provision of suitable networking services has a dramatic effect on the co-ordination functions of State systems and of schools. These services are enhanced by support centres.

The clear thrust towards 'stand alone' microcomputers used in schools may have obscured the equally important aspects of networking. A networked system shows some very important features, especially with i's capability of increasing communication between users. Through the dissemination of draft documents and courseware, 'electronic mail' etc., isolation is lessened and greater opportunities for co-operation are created. Also the network can maintain databases of information which are related to users of the network, and which can be added to or altered by users. Examples are skills registers and courseware written by schools.

The concept of networking is of such potential importance that it should be developed fully. The Committee believes that the National Co-ordinating Committee should address this issue as a matter or urgency.

Hardware Acquisition and Maintenance: Purchase price negotiations at a national level could be an effective means of achieving the lowest cost in hardware purchases. This area should be investigated with responsibility for this investigation being given to the proposed National Co-ordinating Committee. One possible mechanism could be for a State to undertake such negotiations on behalf of Australia.

It is considered that hardware maintenance is impractical at a national level and any advantages of national maintenance contracts would be offset by overheads, storage and remoteness from decision makers.

Environment Aspects: In planning for the use of computers in schools the Committee believes that it is important that attention be given to ergonomic and environmental aspects. Until recently the number of computers in schools has been small; most secondary schools have only one or two microcomputers. This level of equipment means that there is very little concentrated interaction between student and machine. With increased use of microcomputers and changes in the nature of learning activities which will take place (e.g. the increasing introduction of word processing for writing) student time at work stations is likely to increase.

Industry representatives have suggested that any person who operates screen based equipment for more than two hours on any one day and for an aggregate of fifty hours per year should be provided with equipment/surroundings which are ergonomically designed. The Committee believes that equipment should not be purchased entirely on the basis of best price for functions provided. It believes that design and health aspects are also important.

In Appendix F the Committee has outlined a number of the aspects which it believes need to be taken into account in relation to computer equipment and associated furniture needs.

Recommendations

It is recommended that:

(1) Hardware research and development be undertaken as outlined in Appendix E and summarised on page 44 of this report.

(2) In the short-term, the following microcomputers be supported for the purchase of hardware, the provision of maintenance and the development of software and courseware:
    BBC Acorn (with or without Z-80 and CP/M support)
    Microbee 64
    Apple II/IIe

(3) Support also be provided for professional development and consultancy activities directed at other machines recommended by participating systems.

(4) The list of microcomputers to be supported under the Program be regularly reviewed in the light of changes in technology and schools' needs.

(5) Where financial support is provided to schools for the purchase of microcomputers, the guidelines outlined in this chapter apply.

(6) In the short-term funds for the purchase of hardware constitute a minor part of the overall funding of the Program in each State and sector.

(7) Priority in the provision of funds be given to Disadvantaged Schools and others serving needy communities.

(8) An investigation be carried out as soon as possible as to the feasibility of achieving a national purchase price for hardware.

6

A PROPOSED ORGANISATIONAL STRUCTURE

In this chapter the Committee sets out the administrative arrangements which it considers should apply to the Program. The arrangements which the Committee has suggested at State level reflect the decision of the Government to allocate separate amounts for government and non-government sectors and not to designate the program as a joint one.

Government Schools: State and Territory Level

For government schools the Program should be administered on the advice of representative committees. These committees should be responsible for advising on priorities for the allocation of funds, the administrative procedures which should be followed, and the evaluative activities to be undertaken. In recommending on these areas the committees should follow guidelines which are approved for the Program.

The Committee believes it important that the membership of the State Committees include personnel not only from the Education Department but also parent and teacher organisations. The Education Department representation should include at least one officer involved in Equal Opportunities Programs, while the teacher representation should include a person associated with the computer education group in the State/Territory. So that some co-ordination can be achieved between the government and non-government sectors the Chairperson of the State Planning and Finance Committee's Computer Education Sub-Committee (see page 49) should also be a member of the government schools committee. Community involvement in decision making is particularly relevant to the Program. As well as parents, teachers and education administrators, consideration should be given to the inclusion of business and industry representation. Such representation should be able to contribute information about technological change and its impact in the world of work.

Apart from advising on the allocation of funds and the administration of the Program at the State level, the committee should also establish procedures for monitoring the implementation of the Program and be responsible for the preparation of an annual accountability report on its operation.

Non-Government Schools: State and Territory Level

In each State and Territory the Commonwealth Schools Commission has established Planning and Finance Committees. These Committees have the responsibility for recommending the allocation of funds to non-government schools for a range of programs.

The Committee believes the most appropriate way of administering the funds for the Computer Education Program for the non-government sector is to use the Planning and Finance Committee structure. In each State and Territory the planning and Finance Committee should establish a Computer Education Sub-Committee to advise the Planning and Finance Committees on the allocation of funds for the Program. The Planning and Finance Committee would then make recommendations to the Commonwealth Schools Commission on the priorities which should be followed in a particular State/Territory and the allocation of funds for services among schools.

In establishing the sub-committees the Planning and Finance Committees should have the power to co-opt members so as to ensure there is a range of expertise available. The sub-committee should include parent and teacher representation. The chairpersons of the State/Territory Government Computer Education Committees should be ex-officio members of the Computer Education Sub-Committees of the State Planning and Finance Committees. Consideration should also be given to the inclusion of business and industry representation.

As the Government has provided separate funding for the government and non-government sectors the Committee has recommended a Committee for each sector. However, the Committee would have no objection to a particular State or Territory establishing a joint committee to recommend on the administration of the Program if those associated with both sectors agree.

The Committee believes it important that the various co-ordinating committees be given as much flexibility as possible in developing the Program within the established Guidelines. However, it is important that some national overview be gained of the direction in which the Program is developing. For this reason the Committee believes that a detailed 'forecast' of each sector's program should be forwarded to the Commonwealth Schools Commission in August or September of each year. This timetable will not be possible for 1984. Such a move will provide the Commission with advance information and the opportunity to indicate areas where co-ordination and co-operation are possible or necessary.

National Level

The Committee believes that it is essential that some mechanism be established to facilitate national co-ordination, co-operation and monitoring of the Program. It is therefore recommending that a National Co-ordinating Committee on Computers in Schools be appointed by the Commonwealth Schools Commission. This co-ordinating committee would be responsible for:

- advising the Commission on the development of the Computer Education Program;
- acting as a co-ordination focus for the various State/Territory government and non-government programs;
- advising the Commission on which projects of national significance should be developed and supported;

- advising the Commission on co-operative ventures which should be undertaken in the curriculum and software development area;
- advising the Commission on evaluation and associated activities which should be undertaken.

The membership of the National Co-ordinating Committee should include the chairpersons of the various State/Territories Government Schools Computer Education Committees, non-government schools and systems representation and representation from parent and teacher organisations from both the government and non-government sectors. In constituting the membership of the Committee from these groups the Commission should ensure some representation from persons involved in Equal Opportunities Programs. Representation should also be sought from the Commonwealth Department of Science and Technology and from the business and computer industries. The National Co-ordinating Committee should have the resources to establish specialised subcommittees to provide it with advice.

The Committee believes that for all committees linked with the Program, efforts should be made to achieve balanced representation of men and women.

Evaluation

Evaluation is an essential element of the Program and should be carried out at the school, State and national level. The National Co-ordinating Committee should develop procedures for monitoring the operation of the Program. It should carry out evaluations of the Program's performance in meeting its specific goals. The National Co-ordinating Committee should also establish a research and development program, using funds from the Commission's Projects of National Significance Program or from an amount earmarked from the Computer Education Program.

Schools should be encouraged and assisted to conduct their own evaluations. These evaluations should allow schools to review progress and change direction or emphasis as necessary. Similarly, State Committees should accept responsibility, in consultation with the National Committee, for continued evaluations of aspects of the program.

Projects of National Significance

The Committee is aware that the Commonwealth Schools Commission has recommended that an amount of $150 000 be allocated to support national projects related to the use of computers in schools that may provide information to guide the development of the Computer Education Program. The Committee suggests that the National Co-ordinating Committee recommend on priorities and administration of these funds. The following are among the types of projects which the Committee believes need to be considered:

- methods of transferring effective classroom practice in computer use from one school to another;
- adaptation of courseware packages to suit Australian schools;
- the use of computing in areas such as the development of problem-solving skills, writing, development of mathematical concepts;
- studies of research projects being undertaken or completed that relate directly to practical issues associated with educational applications of computing; dissemination of the findings;

- development of strategies and activities that are effective in improving access to groups who may otherwise not achieve an appropriate level of involvement in computing in schools;
- investigation of the manner in which classroom use of computing influences student-student, student-teacher and teacher-teacher interaction.

Role of the Curriculum Development Centre

The Committee reiterates its belief that for the use of computers in schools to improve the education offered to students it is essential that curriculum development and associated activities be undertaken. The Commonwealth Government has reactivated the Curriculum Development Centre and the Committee is of the opinion that the Centre should give immediate priority to developments in the schools computing area. The Committee believes that it is essential that in developing a program of activities the Curriculum Development Centre liaise closely with the National Co-ordinating Committee on Computers in Schools and the various State systems. Activities which need immediate attention include:

- the production of a handbook outlining the issues involved in curriculum planning for the use of computers in schools;
- the establishment of a software information dissemination system;
- the production of resources which could be used by students and teachers in teaching and learning activities associated with computer awareness and literacy activities.

Computers and other Commonwealth Education Programs

The Committee is aware that funds from other Commonwealth Education Programs, such as the Disadvantaged Schools, Country Areas and Transition Education Programs, have been used to support activities related to the use of computers in schools. As it is likely that the practice will continue, the Committee recommends that the principles and specifications applying to the Computers Education Program should also apply when funds from other Commonwealth programs are used to support activities and equipment related to the use of computers in schools.

RECOMMENDATIONS

It is recommended that:

(1) For government schools the Program be administered on the advice of representative Committees.
(2) For non-government schools the Program be administered on the advice of the Commission's State Planning and Finance Committees.
(3) A National Co-ordinating Committee on Computers in Schools be appointed.
(4) The National Co-ordinating Committee on Computers in Schools develop procedures for the effective evaluation of the Program and for research and development activities.
(5) The Curriculum Development Centre give priority to the area of computers in schools.
(6) Where other Commonwealth Education Programs are used to support activities and the purchase of equipment related to the use of computers in schools, the principles and specifications applying to the Computer Education Program apply.

7

SUMMARY OF RECOMMENDATIONS

CURRICULUM DEVELOPMENT

(1) Curriculum development activity take place within and between the existing curriculum development structures and agencies at the national and State levels.

(2) Immediate support be given to the establishment of a national mechanism for the dissemination of information about curriculum issues (including evaluation) which arise from the introduction and extension of computing in schools and that the reactivated Curriculum Development Centre be closely involved in this task.

(3) The first priority for curriculum be the provision of computer awareness and computer literacy experiences for all students in the years of compulsory secondary schooling.

(4) A second priority is to promote the integration of computing into the school curriculum, in primary as well as secondary schooling.

(5) A third priority is the provision of optional computer studies courses at the secondary level, to allow studies at some depth.

(6) Special consideration in funding be given to the development and implementation of curricula for girls, students living in isolated areas, Aboriginal students and those coming from other racial and ethnic minorities, students who are socio-economically disadvantaged and disabled students.

(7) Funds be made available to investigate the effects of computers on the learning environments of particular groups of students.

(8) Encouragement be given to the development of curriculum materials and processes which provide greatest opportunities for learners' success, and for co-operative group learning as distinct from individualised competitive learning.

PROFESSIONAL DEVELOPMENT

(9) In 1984 Professional Development activities in the computers in schools area be given high priority in the allocation of funds from the Computer Education Program and from the Commonwealth's Professional Development Program.

(10) Delivery mechanisms developed by States and systems should pay particular attention to the full participation of women teachers, non-mathematics and -science teachers and disadvantaged groups amongst teachers. It may be necessary to provide special courses for these groups.

(11) Participation of men and women in Professional Development activities reflect their proportion in the teaching service on a State-by-State basis.

(12) In the implementation of delivery systems for professional development, existing structures be used and further developed.

(13) In implementing the Professional Development component of the Program, States and systems choose from a selection of alternatives. Among the options available are long and short courses, the establishment of mobile consultancy teams, school networks, action research, audio-visual tutorials, television courses in and out of school time and regional, State and national conferences.

(14) In any projected professional development schemes the central role of the school principal be recognised and reinforced.

(15) Tertiary institutions engaged in the pre-service education of teachers include in the courses of all students, studies of the application of computers to education. It is recommended that the Commonwealth Schools Commission discuss with the Tertiary Education Commission ways on which this could be achieved over the next Triennium.

(16) Efforts be made to identify, to make known and to support persons who are able and are prepared to provide leadership in schools computing. These people should be assisted to keep in touch with world-wide developments and to set up among themselves a mutual support and information network for the benefit of schools and systems.

(17) Teacher Associations in all subject areas be encouraged to allocate a segment of their conference programs to the applications of computer use in their subject areas.

SUPPORT SERVICES

(18) States be encouraged to commit some of the Program funds allocated to them to hardware and system software in support centres.

(19) The feasibility of joint access to support centres for both government and non-government schools in each State or region be explored.

(20) Discussion be initiated with the Commonwealth Tertiary Education Commission to identify tertiary institutions with access to appropriate expertise. Consideration be given to funding a support facility in each institution which will increase the number of teachers with substantial expertise in computing topics including, if possible, a study of computer science.

(21) As the provision of co-ordinated Support Services is best made through the establishment or further development of comprehensive centres or units in each State or Territory, funds be used to supplement the recurrent costs associated with the establishment or expansion of such centres or units.

(22) The guidelines associated with funding for centres and units allow for operational costs of regional and district facilities.

(23) Provision be made to allow for the flexible use of funds consistent with the functions and services described in this Report.

(24) A National Computing Network based on these centres be established progressively to support the co-operative and integrated nature of the national program.

(25) Consistent with the maintenance of effort within each State and Territory, funds from the national program be made available for the training and associated operational costs of consultants and also for the employment of additional consultants.

(26) Special measures be taken to appoint qualified women within the support structures for computing in schools. This may require the development of employment

and training policies to increase the number of women with suitable qualifications and/or teaching experience.

(27) The importance of supporting teachers in schools, not only through the services described, but also by encouraging initiative at the school level and facilitating the sharing of such developments and information through the centres and units be recognised. Small grants should therefore be made available for the support of innovative practice in schools.

SOFTWARE/COURSEWARE

(28) General purpose software for word processing, spreadsheet, database and statistics/data reduction be available from program funds for the recommended hardware.

(29) As a matter or urgency the Commonwealth Schools Commission establish mechanisms to:
- (i) provide for the acquisition, adaptation or development of general purpose and subject specific software and courseware;
- (ii) allow for appropriate marketing procedures;
- (iii) assess the continuing software and courseware needs of schools.

(30) In establishing these mechanisms the Commission work closely with the Curriculum Development Centre in providing appropriate support and implementation structures.

(31) The mechanisms referred to above be funded initially by the Commonwealth but should aim to generate adequate income to become self-sufficient in the longer term.

(32) Software/courseware intended for widespread use be developed using a team approach with the team consisting of teachers, programmers and other qualified personnel as required.

(33) Software development aids be available to assist teachers to develop software/courseware for their own use, e.g. graphics tablets, light pens, language compilers, programming standards.

(34) Development work be carried out in centralised computer centres where appropriate.

(35) With regard to computer programming languages, in the short-term the following be supported:
- (i) for students, at least LOGO, Pascal and BASIC available for the supported hardware;
- (ii) for software production, the versions of BASIC available for the supported hardware, LOGO, Pascal and hardware dependent machine code where appropriate.

(36) In the longer-term:
- (i) the set of languages for student use be reviewed regularly;
- (ii) the feasibility of an interpreter/compiler for a single dialect of a language suitable for software development on all supported hardware systems be investigated;
- (iii) a study be undertaken to investigate the use of fourth and later generation languages.

(37) The national program only support software and courseware that meets valid educational needs and is free of sex role stereotyping, racial or social bias and which facilitates progress to more equal educational outcomes.

(38) The draft document covering design methodology, design specifications, programming, coding and packaging be completed to a stage where it is suitable for publishing and when published the document should be made available as a guide to teachers and other software and courseware developers. It should be the subject of further development by the Commission.

HARDWARE

(39) Hardware research and development be undertaken as outlined in Appendix E and summarised on page 44 of this report.

(40) In the short-term the following microcomputers be supported for the purchase of hardware, the provision of maintenance and the development of software and courseware:
BBC Acorn (with or without Z-80 and CP/M support)
Microbee 64
Apple II/IIe

(41) Support also be provided for professional development and consultancy activities directed at other machines recommended by participating systems.

(42) The list of microcomputers to be supported under the Program be regularly reviewed in the light of changes in technology and schools' needs.

(43) Where financial support is provided to schools for the purchase of microcomputers, the guidelines outlined in Chapter 5 of this report apply.

(44) In the short-term funds for the purchase of hardware constitute a minor part of the overall funding of the Program in each State and sector.

(45) Priority in the provision of funds be given to Disadvantaged Schools and others serving needy communities.

(46) An investigation be carried out as soon as possible as to the feasibility of achieving a national purchase price for hardware.

ORGANISATION

(47) For government schools the Program be administered on the advice of representative Committees.

(48) For non-government schools the Program be administered on the advice of the Commonwealth Schools Commission's State Planning and Finance Committees.

(49) A National Co-ordinating Committee on Computers in Schools be appointed.

(50) The National Co-ordinating Committee on Computers in Schools develop procedures for the effective evaluation of the Program and for research and development activities.

(51) The Curriculum Development Centre give priority to the area of computers in schools.

(52) Where other Commonwealth Education Programs are used to support activities and the purchase of equipment related to the use of computers in schools, the principles and specifications applying to the Computer Education Program apply.

APPENDIX

A

EXTRACTS FROM THE COMMONWEALTH GOVERNMENT'S GUIDELINES TO THE COMMONWEALTH SCHOOLS COMMISSION FOR 1984

Computer Education

The Schools Commission has already established a National Advisory Committee on Computers in Schools and is examining issues related to the introduction of a national Computer Education Program. The Government will look to advice from the Commission to enable implementation of this program in 1984 on the basis that the program will have regard to the following:

- the need for students to have an understanding of the uses of new technologies and their social, environmental, industrial and economic effects;
- planning for the use of computers in teaching and across the curriculum, and the impact of computers and computer-based programs on the curriculum as a whole;
- professional development of teachers;
- access to the program by girls and disadvantaged groups;
- the economic use of resources, including where appropriate support for the sharing of service between schools and sectors, and across States, and the standardisation of equipment and materials.

Because of the need for effective forward planning in a program of this nature, the Government has decided to provide $18m for the triennium 1984–86. Initially the program will concentrate on secondary schools. For the period beyond 1984, the Commission is asked to prepare options on possible future policy directions for this program, including extension to primary schools.

SPECIAL PURPOSE PROGRAMS

Computer Education

For the Computer Education Program the Government will provide $18m for the calendar years 1984–86 for schools in all States and Territories, commencing with $6m in 1984, of which $4.8m is allocated for government schools and $1.2m for non-government schools. While funds are being provided separately for each sector, the Commission nevertheless should ensure that all elements of this program are co-ordinated to achieve efficient use of resources, consistent with the Government's objectives.

APPENDIX

B

MEMBERSHIP OF THE NATIONAL ADVISORY COMMITTEE ON COMPUTERS IN SCHOOLS AND THE ASSOCIATED TECHNICAL WORKING PARTIES

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Commonwealth Schools Commission
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Department of Science & Technology
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Mr B. Bahnisch
Assistant Director, Resources Services
Division of Curriculum Services
Queensland Department of Education
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NORTH QUAY QLD 4000

Mr N. H. Campbell
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(From 24 August)

Mr D. Francis
Assistant Secretary
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Mr J. Hamilton
Principal Curriculum Consultancy Unit
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Mr A. Henry
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PMB 25
WINNELLIE NT 5789

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Miss M. Miland
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Commonwealth Schools Commission
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CAMBERWELL VIC 3124
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Ms R. Pringle
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(To July)

Mr L. D. Russell
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Education Dep't of SA
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SYDNEY NSW 2001

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Mr B. Young
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PROFESSIONAL DEVELOPMENT TECHNICAL WORKING PARTY

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Mr Peter Sandery
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Mr Frank Mines
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Professional Development Technical Working Party
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Ms Anne Williams
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Mr Frank Mines
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Mr Mike Coleman
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Information Technology
Department of Science and Technology

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School of Electrical Engineering
NSW Institute of Technology

Mr Ashley Goldsworthy
President
Australian Computer Society

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Mr Barry Manefield
Principal
Denistone East Primary School
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Prof. Arthur Sale
University of Tasmania

Mr Fred Symons
Assistant Director
Research Laboratories
Telecom Australia
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Mr David Woodrow
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Mr Peter Sandery
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Mr Mike Coleman
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EVALUATION TECHNICAL WORKING PARTY

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Ms Diana Banks
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Evalution & Research Section
ACT Schools Authority

Professor Michael Scriven
Professor of Education
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Dr Jill Maling
Director
Academic Programs
S.A. College of Advanced Education

Mr Peter Sandery
Consultant
Commonwealth Schools Commission

Mr Frank Mines
Commonwealth Schools Commission

APPENDIX

C

LIST OF ORGANISATIONS CONSULTED BY THE COMMITTEE

Commercial and Professional Associations

Australian Computer Equipment Manufacturers' Association
Australian Computer Equipment Suppliers' Association
Australian Computer Society
Australian Software Houses Association
Computer Education Group, New South Wales
Computer Education Group, Victoria
Computer Education Group, Queensland
South Australian Computer Studies Teachers Association
Education Computing Association of Western Australia
Computer Studies Teachers' Association, Tasmania
Computer Education Association of the Northern Territory
Computer Education Group (ACT Schools)

APPENDIX

D

PROFESSIONAL DEVELOPMENT: SKILLS AND KNOWLEDGE

1 Introduction

A set of professional skills and understanding has been developed for various groups of teachers. The skills listed do not necessarily describe particular jobs or levels of appointment nor do they specify the source of the people to do the tasks suggested. Schools and school systems should encourage involvement in computing by teachers who have a variety of associated skills and backgrounds. Thus at a systems level it is imperative that computing teachers include women teachers, non-mathematics and -science teachers, as well as mathematics and science teachers. The skills listed represent functional characteristics of categories of staff and, as such, apply equally to any individuals filling such roles. The targetting of specific groups (such as women, ethnic groups) should be done in the implementation of the professional development program by the selection processes used. Such targetting is not appropriately done by specifying separate sets of skills for these groups.

2 General Subject Teachers

Skills and understanding which will assist in using computing to enhance teaching and learning in the subject area.

- Awareness of the potential of computing in the teaching of the subject; familiarity and understanding of the extent and nature of computer use in the subject area outside schools.
- Minimum knowledge (level similar to that suggested for Computer Awareness Teachers) of equipment operation, maintenance and care.
- Working knowledge of available software, sources of software, and sources of information to keep this knowledge up to date.
- Software selection skills.

- Classroom organisation skills, integration of equipment use into lessons; use of demonstration and small group techniques.
- Awareness of changes in curriculum shifts in emphasis due to new technologies.
- Ability to discuss social impact of information technology on the subject area.

3 Systems Administrators

- Understanding of the capabilities of computers.
- Awareness of the uses of computers in educational contexts.
- Experience with using educational software and administrative packages.
- Ability to make informed decisions concerning hardware, software and staffing, including ability to evaluate submissions relating to expenditure on computing.

4 Principals and In-school Administrators

The national Computer Education Program depends for its success on school principals.

- Understanding of the role information technology can have in the schooling process.
- Ability to balance competing demands, make decisions in the best interests of students from a position of informed judgement about computing.
- Ability to support and initiate teacher developing in computing.
- Ability to provide direction for in-school curriculum development, adaptation and evaluation resulting from use of information technology.
- Ability to provide leadership in encouraging the whole staff to become involved in the school's computing program.
- Awareness of effects that use of information technology is having on curriculum and related questions.
- Ability to communicate with parents and the community about the computing program in the school.

5 Computing Studies Consultants

These people should already be recognised as highly competent teachers in the computing area.

- Detailed knowledge of and ability to advise on supported equipment, course guidelines, software, resources, etc. and sources of information about developments in these areas.
- Knowledge of relevant departmental policies.
- Knowledge of approved courses provided by outside institutions for teachers wishing to upgrade qualifications in computing and computer education.
- Ability to organise professional development activities for school personnel.
- Ability to communicate with parent groups.
- Working knowledge of adult learning strategies.
- Skills related to evaluation and facilitation of positive change.
- Interpersonal skills.

6 In-school Computing Resource Teachers

It is envisaged that a teacher with such skills and understanding would be needed in each school, once it had a reasonable amount of equipment and computing activity.

This person may already be either a Computer Studies, Computer Awareness or Literacy Teacher, a General Subject Teacher or a Teacher Librarian. Ideally this teacher should have an appropriate time allowance.

Additional skills needed:

- Ability to manage the total school computing resource.
- Ability to develop an environment in which all teachers and students (including girls and women and those not involved in mathematics and science subjects) feel confident to participate in computing activities in the school.
- Ability to gather and disseminate information about computing activities that is relevant to the school.
- Ability to assist teachers in evaluation and selection of appropriate instructional materials which require computing facilities.
- Knowledge of software library acquisition, maintenance and overview of use and needs.
- Ability to develop and maintain an in-school in-service program which will involve all teachers in the school.
- Ability to liaise with staff of support structures and other resource centres outside the school, e.g. the Australian Computer Education Groups, Computer Studies Teachers' Associations.
- Ability to act as a resource for parents on educational computing questions.
- Some skills in selection, acquisition and use of computers and computer services suitable for the enhancement of learning.
- Knowledge about maintenance of equipment, and, for example, an ability to decide when or whether equipment needs to be sent away to be fixed.
- Knowledge of equipment—security, insurance, booking of time, organisation and co-ordination and overview of use of needs.

7 Computer Awareness/Literacy Teaching (teaching up to year 10)

These teachers will be responsible for teaching computer awareness/literacy courses and for providing computer experiences for students to achieve the aims of such courses.

It is envisaged that coursework of the order of 60 hours would be the minimum required to attain the relevant skills.

- Working knowledge of computer awareness/literacy course guidelines.
- Classroom management skills relating to control, use of and equitable access to equipment and its integration into lessons.
- Competence in using hardware and software in both demonstration and small group modes.
- Skills appropriate for teaching social issues arising from use of information technology. These include discussion, social analysis, use of video and other resources for this purpose and setting and marking of essay work.
- Competence to run and assess package software, to handle simple faults (power cords, drives needed or not, printer connection, etc.) and care of equipment.
- Knowledge of printed and other resources for teaching computer awareness/literacy courses and of sources for keeping this knowledge up to date.
- Knowledge of suitable software to support the aims of the courses and of sources of new software.

- Skills in selection of suitable software for these courses.
- Ability to identify and use general sources of current information about computing as it relates to computer awareness courses.
- Ability to discuss social issues that relate to use of information technology generally and to educational uses in particular.
- Enough computer programming skills to be able to teach programming at the level indicated by computer awareness/literacy course guidelines.
- Understanding of and ability to implement good programming practices.
- Working knowledge of the use of the computer as an information handling tool.

8 Software Designers

- Appreciation of the processes and problems involved in developing computer based learning materials in a particular subject area.
- Working knowledge of relevant courseware development, software specification and software writing standards.
- Knowledge of software development techniques developed elsewhere and of sources for keeping this knowledge up to date.
- Familiarity with evaluation criteria developed by software evaluation projects.
- Skills in formative evaluation.
- Enough knowledge of computer programming to know what is possible and what is not, but not necessarily high level programming competence; ability to communicate clearly and easily with a professional programmer.
- Working knowledge of author languages.
- Skills in specifying background notes, worksheets, full documentation and audio-visual or other resource materials that might form part of software packages.
- Familiarity with the capabilities of graphics and animation techniques such as graphics tablets, sprites.
- Skills for working in teams: communication of ideas criticism, discussion, writing clear presentation of ideas or criticisms, etc.
- Understanding of the role of media in teaching and learning.

9 Software Programmers

- Tertiary qualifications in Computer Science or equivalent.
- Ability to work in teams with Software Designers and Teachers.

10 Teacher Librarians

- Skills in identification and selection of materials to support teaching and learning about computing.
- Awareness of existing library administration packages, their strengths and possible shortcomings in various environments.
- Awareness of the use of the computer for resource management in the school library.
- Training in the use of the computer as an information handling tool, and for identification and teaching of these skills to students.
- Minimum knowledge (level similar to that suggested for Computer Awareness Teachers) of equipment operation, maintenance and care.
- Awareness of changes in curriculum and shifts in emphasis due to new technologies.
- Ability to discuss the social issues that relate to use of information technology generally and to educational uses in particular.

11 Primary Teachers

- Understanding of how computing can affect on both the process of content of primary education.
- Basic knowledge of the capabilities, limitations of computer hardware; confidence in setting up and using a microcomputer system.
- Working knowledge of a computer programming language suitable for use with primary school children and ability to use it to enhance children's learning (e.g. using the computer as a means to solve problems, learn mathematics, explore language).
- Skills in software selection.
- Classroom organisation skills which enable the integration of computing into classroom practice.
- Appreciation of wider social and educational implications of use of information technology.

12 Computer Studies Teachers (teaching up to year 12)

Qualifications: At least two years of Computer Science at undergraduate level, or equivalent, and teacher training courses including a subject such as Methods and Practice of Teaching Computer Studies.

The following skills and understanding are required:

- All the skills listed for Computer Awareness/Literacy teachers.
- Working knowledge of relevant curriculum guidelines for computer studies, and/or computer awareness courses.
- Teaching skills appropriate for these courses.
- Familiarity with and competence in using equipment and programming languages suitable for schools.
- Knowledge of available printed, audio-visual and other teaching resources for such curricula, and of sources of information for keeping this knowledge up to date.
- Understanding of trends in information processing, and awareness of developments in both hardware and software; in the case of teachers who have not recently graduated, retraining may be required.
- Competence to organise and run a school computer club.
- Ability to provide advice of a technical nature to other school computers users.

APPENDIX

E

HARDWARE ACQUISITION PROCESS

Introduction

1 The National Advisory Committee on Computers in Schools has recommended that the research, design and development process described below be adopted. This process would involve:

- Commonwealth Schools Commission co-ordination and funding of the research and development of educational requirement documentation and;
- Department of Science and Technology co-ordination and funding of computer equipment research, design and development.

Elements of the process are:

(a) Commonwealth Schools Commission leadership in the research of requirement documentation, namely:
  (1) An Educational User Requirement; and
  (2) An Educational Technical Requirement.

(b) Department of Science and Technology leadership in equipment research, design and development through:
  (1) A Systems Concept Study; and
  (2) An Australian Design Specification including the design and manufacture of pilot and prototype systems, if necessary.

Educational User Requirement

2 With the assistance of the National Co-ordinating Committee on Computers in Schools (NCCCS) the Commonweath Schools Commission should develop an Educational User Requirement. It may be necessary to develop a separate Educational User Requirement for each level of computer system: support centre, secondary and primary. A specially established and funded expert steering Committee could develop the Educational User Requirements for consideration by the National Co-ordinating Committee on Computers in Schools and the Schools Commission.

3 The Educational User Requirement is a statement of recognised educational needs which should be met by computer systems. The application of computers in schools identified under the curriculum development heading of the report (see Chapter 4) may form a starting basis of the Educational User Requirement.

Educational Technical Requirement

4 As with the Educational User Requirement, an Educational Technical Requirement is required for each level of computer system. The Educational Technical Requirement is a statement of the function, main features and performance required by the user for a system which can reasonably be expected to be available in the planned time.

5 The Educational Technical Requirement provides a statement of what the user intends to achieve, tempered by considerations of broad resource availability. The Educational Technical Requirement may be used to define requirements for an individual equipment, a computer system or a family of associated equipment.

6 The Educational Technical Requirement should outline the performance capabilities and limitations envisaged for the equipment or systems and any relative priority between them. Performance capabilities are to be stated in general terms and are to be related to functional user considerations rather than the means of achieving them. The practice of writing an Educational Technical Requirement around specific available or projected equipment or too tightly about the state of the art is to be avoided. To do so would limit choice and could influence decisions in the direction of equipment or technologies which may be inappropriate.

7 Any statement of desired characteristics should be prefaced by a caveat along the following lines:

> The performance capabilities listed below represent the goal. If in their attainment it seems likely that unreasonable penalties will be incurred in terms of costs, manpower, time, technical risk or other aspects, the matter is to be referred to the originator.

8 The expert steering committee, established and funded to develop the Educational User Requirements, could also be tasked to research and develop the Educational Technical Requirements.

Computer System Development

9 The Computer System Development process follows the historic procedures for industrial research and development in the private sector. It involves a system concept study, a development proposal and the development of a systems design specification.

10 The first step in developing the equipment needed to meet the Educational User and Educational Technical Requirement is a System Concept Study.

System Concept Study

11 The System Concept Study involves technical research and analysis of all practicable alternative solutions by means of which the requirement can be satisfied. It includes consideration of development and production options and use of existing items in modified form.

The System Concept Study does not usually involve experimental work or engineering design. The Study should include:

(a) an evaluation of the significance of the Educational Technical Requirement's various characteristics in computer hardware and software terms to determine their achievability and consequences in terms of project cost (including costs or savings in manpower and facilities or other resources) and time in use;
(b) an evaluation of the various options available to meet the Educational Technical Requirement, in terms of likely performance, maintainability, costs of development and/or production (and the source of cost data used), likely facilities and manpower implications and predicted time to acquire equipment from each option, together with the advantages and disadvantages of each;
(c) initial estimate of the time and other resources required where the development solution or further project definition is recommended;
(d) an examination (in tabular form) of the most likely contenders derived from a market survey, normally based upon Educational Technical Requirement release response information, when procurement of commercial solutions can be proposed;
(e) identification of any areas of technological risk or uncertainty, with recommendations on the method of overcoming them, and on any further project definition and/or development action required and the trials or evaluations strategy proposed;
(f) recommended changes to and/or variations from the Educational Technical Requirement;
(g) recommendation of a preferred solution which does not depend on the Educational Technical Requirement changes suggested but highlights any shortfalls or strengths against the Educational Technical Requirements; and
(h) derived key technical characteristics for the recommended option, suitable for incorporation into procurement or development specifications.

12 The system concept should be developed by issuing a request to undertake a System Concept Study. Three or four tenders should be funded.

13 Where there is no suitable or proposed commercial equipment that will meet the Educational Technical Requirement, it is necessary to prepare a Development Proposal. The Development Proposal can be included as part of the System Concept Study or as a separate phase of computer system development.

Development Proposal

14 A Development Proposal is an appreciation of the various options available, with a recommended course of action. It should also include:

(a) the recommended development or product-improvement timetables and any special project co-ordination arrangements proposed;
(b) a detailed estimate of cost of the project development stage now recommended for endorsement, the source for this cost data and programming actions taken or planned;
(c) a broad assessment of significant production or other technical or risk aspects which could influence development;
(d) any project review points recommended for the computer system development or studies suggested, and proposed level of referral for these milestones;

(e) an outline plan for any major action necessary to meet associated non-equipment requirements such as facilities and training, on which concurrent development or study might be required;

(f) details of proposed trials, tests, evaluation and other acceptance requirements for the solution recommended; and

(g) key aspects of the suggested initial development specification (or product-improvement specifications if the use of a commercial item is intended) or an attached Educational Technical Requirement for approval, with supporting arguments if there is to be any recommended departure from the Educational Technical Requirement.

Australian Design Specification

15 One or a number of system concepts are then approved. A development proposal is finalised and contracts are let for the development of a detailed design specification including full documentation. The development of a system design includes pilot and/or prototype production, test and evaluation.

16 Although it is common practice in the United States to contract a number of design specifications, (eg in the development of the computer programming language ADA), it would be difficult, in the Australian context, to justify expenditure on more than one system design specification for each of the support centre, secondary school and primary school computer systems.

Procurement

17 States would tender in the normal manner to meet their computer systems re-requirements. The Australian Design Specification would be made available to any Australian based company as a basis for tender. The procurement process would follow approved purchasing practices, within appropriate Commonwealth and State policies.

APPENDIX

F

THE SCHOOL COMPUTER ENVIRONMENT

Computing equipment should be designed to minimise operator fatigue and, where possible, avoid long-term side-effects. Listed below in point form are issues which it would be advisable to take into account when introducing computers into schools, having regard for possible longer term effects. These issues will become more important as the amount of equipment in schools increases and students spend proportionally more time using computer equipment in the school environment.

1 Computer Equipment

Visual Display Screen:

- Should be designed for computer output, ie not a TV set.
- Character display should be legible with attention paid to
  - —character shape, spacing, size and dot matrix resolution; should allow ease of reading at 0.5m viewing distance;
  - —stability; there should not be any flicker, jitter or shimmer;
  - —screen and character colour; green or black is most appropriate for low light level, amber for higher room lighting levels;
  - —contrast, focus and brightness control must be available for the operator to adjust.
- Must be electrically safe with acceptable levels of radiation emission.
- Should be tiltable and rotatable and have a means of reducing specular reflection from its surface.

Keyboard:

- Should be detachable.
- Should be located at a suitable height to avoid stress on the arms and wrists.
- Key operation should provide feedback (tactile, visable or audible) but not to the point where this provides distraction.
- Keyboard layout should suit the task, with separate special function keys if necessary; concave shaped keys are preferable.
- Key colour and marking should allow easy identification and the finish should reduce specular reflection.

Printer:

- Should be encased in an acoustic shield to minimise noise. (This applies to any other noise producing peripherals.)

2 Furniture

Table:

Particular attention should be given to the physical dimensions of the student users of the computers and furniture sizes adjusted accordingly.

- Work surface should be adjustable in height and angle to suit operator.
- Work surface should be large enough to allow suitable placement of screen, keyboard and any other essential items.
- No sharp edges or surfaces that could cause injury.
- Stable enough to take weight of display, etc. and withstand keyboard use without movement.
- Surface finish should be of low friction to minimise movement of equipment.

Chair:

- Castors or slide depending on floor surface.
- Adjustable seat height.
- Adjustable back support.
- Upholstered in fabric that maximises operator comfort, minimises static build-up.
- All seating adjustments to be easily made by the user.

3 Illumination

- No bare lights—recessed fluorescent lighting is preferable.
- Screens and other devices should be placed to minimise the glare from windows.
- Suggested standards exist for combined lighting levels suitable for work with visual display equipment.

4 Room Construction—Environmental Conditions

- Walls and ceiling should minimise reflected sound.
- Floor covering should preferably be carpet, with a minimum of artificial fibre to avoid static discharge.
- Suitable humidity/temperature control for user comfort and equipment reliability.
- Wiring to be arranged in a manner that cannot result in a safety hazard.
- Ease of entry and exit to room should not be limited by equipment placement.
- To accommodate a possible computer network, additional power outlets and cable channels may be required. The power should not be drawn from school wiring susceptible to overload.

5 Equipment Security

Special provision may need to be made to ensure the protection of computer equipment. Security provision must be considered in the light of creating the correct user environment. A degree of mobility of equipment is essential, as is creating a conducive working environment. Unobtrusive security provision is therefore essential. Expert advice should be sought.

6 Aesthetics

Few computer rooms in schools have much aesthetic appeal. They have been designed like labs, to serve classes in computer science. The environment desirable to motivate creative work by individuals or small groups requires something different.

Attention is needed in the area of workstation layout and decor (colours, contrasts, use of screens and furnishings) to create variable and pleasant working spaces.

Bare floors, bars on the windows and furniture scraped up from around the school are unsuitable.

APPENDIX

G

GLOSSARY OF TERMS

BASIC	A high level computer language widely used for microcomputers. Stands for Beginners All-purpose Symbolic Instruction Code. It was originally developed at Dartmouth College in the USA as a language for students to use.
Bit	A binary digit, O or 1.
Byte	A group of 8 bits. Usually the minimum amount of information needed to store a character.
CAD	Computer Aided Design. Usually the use of a computer graphics system to assist a designer.
CAI	Computer Assisted Instruction. A form of computerised programmed learning. In its most common form, it uses the computer to present drill and practice activities giving the user individualised practice in concepts or skills introduced by other means. May also refer to use of the computer to present material in a tutorial mode.
CAL	Computer Assisted Learning. Use of the computer in a manner that places greater emphasis on activities initiated by the learner. In addition to the tutor and drill and practice role of CAI, CAL provides opportunities to acquire new knowledge and skills using the computer as a tool.
CML	Computer Managed Learning. Use of the computer to store records of a student's progress through a series of assignments, to perhaps guide choice of future assignments based on an analysis of stored performance. May also involve test construction and course management.
CP/M	Control Program/Microprocessor. An operating system developed by Digital Research in the USA.
Character	An all-purpose expression for numerals, letters and any special symbols that a computer can display on a screen or printer or accept as input.
Chip	A single device containing a large number of transistors and other electronic components that have been formed on the surface of a piece of semi-conductor material, usually silicon. The silicon is subsequently encapsulated in a protective package with electrical connectors to plug it into the computer.

Command	A direct instruction to the computer which is carried out at once.
Compatible	Two computers may be said to be compatible if a program written for one will run (or work) on the other without having to be modified.
Compiler	A set of instructions stored in the computer that translate an entire program written in a high level language into a machine code version which is needed by the computer in order to run the program.
Computer	An information processing device. A machine that is capable of processing (or manipulating) information according to instructions given to it by people.
Courseware	A package of one or more computer programs (on a suitable medium such as a disk) with associated print and audio visual teaching/learning materials.
Cursor	A character, frequently a dash, that appears on a visual display screen marking where the next character will appear.
Data	Usually numbers or characters that a computer can deal with. In organised form data becomes information, although both terms are frequently loosely used.
Database	An organised collection of files of information that a computer may access. Sometimes also referred to as a data bank. There are several types of organisational schemes that may be used, giving rise to the terms relational database, hierarchical database, etc.
Disk (floppy disk, mini floppy disk or diskette)	A flat magnetic disk used to store programs and data. Disks come in a variety of sizes. The most common in use with microcomputers is 5¼ inches in diameter and is called a mini floppy disk.
Electronic Blackboard	Use of a large display screen as a means of displaying computer output, usually in a class or lecture, with the computer being controlled by the teacher.
Fourth Generation Languages	Software that allows users to communicate with the computer using everday English to tailor application software to their particular needs without having to resort to high level progamming languages such as BASIC or Pascal. 4GLs are frequently menu driven.
Hardware	The physical components of a computer, as distinct from the software or programs.
Hard copy	Information that has been printed on paper (usually) by a computer—more tangible and permanent than characters displayed on a screen.
High level language	A programming language that employs constructs that are closer to ordinary written language rather than machine code.
Information Technology	The scientific, technological and engineering disciplines and the management techniques used in information handling and processing; their applications; computers and their interaction with people and machines; and associated social, economic and cultural matters.
Integrated circuit (IC)	A combination of circuits on a chip.

Interactive	A mode of computer use that allows direct and continual two-way communication between user and computer.
Input	The process of entering data or programs into a computer, usually via a keyboard.
Instruction	A computer program consists of a set of instructions, each of which results in some action by the computer.
Interface	The boundary between two parts of a computer system. It may be a physical connection or, when the word is used as a verb, it may mean to make one part of the system run more smoothly with the other. The human interface describes the boundary between the user and the computer.
Interpreter	A set of instructions stored in the computer that translates a high level language, line by line, into a low level form that the computer can act upon. The translation is performed every time the program is run.
Language	In computer terminology, an organised way of communicating with a computer using precisely defined instructions.
LOGO	A high level language developed at the Massachusetts Institute of Technology and used to assist research into the development of problem-solving skills with children. Now widely used as a programming language for children.
Machine code	Low level language. The lowest level language that a programmer may use. A pattern of zeros and ones. All high level languages are converted into machine code by the computer before it can execute or run the instructions. Programs written in machine code can usually be executed faster by the computer than those written in a high level language.
Memory	Computer memory (or store) is a device or series of devices capable of storing information in the form of patterns of binary digits. The information may be stored temporarily or permanently (for the life of the computer). Internal memory usually uses semiconductor devices. External memory is usually in the form of magnetic media—disk or tape.
Menu-driven programs	These are programs which present the user with a series of choices for use of the program. The choices are usually displayed in the form of a menu on a display screen.
Microcomputer	A small computer system, usually built around a microprocessor on a single chip.
Microprocessor	The term is frequently used interchangeably with microcomputer, but a microprocessor is the chip providing the control function for the microcomputer.
Network	A system that allows a number of computers or terminals with their peripheral devices to be electronically connected over a distance. The term Local Area Network usually refers to a network operating over a distance of less than a kilometre, frequently contained within one building.
Operating Systems	A software program package that controls the operation of user programs. Operating systems typically perform a managerial role of controlling input and output operations, allocation of storage and requeuing of programs. Operating systems are frequently specific to

particular brands of computers and are generally supplied by the computer manufacturer. However, in an attempt to facilitate interchangeability of software, a number of microcomputers now run what are regarded as industry standards such as CP/M MS-DOS Unix. Software designed to run on one computer may in certain circumstances run on a different brand of computer using the same operating system.

Pascal	A high level language with a built-in structured format. Pioneered by N. Wirth of Switzerland originally as a programming and teaching aid.
Package	A term used to describe a program or collection of programs and associated descriptive material. The package is usually intended to facilitate use of the computer by non-experts.
Portability	Programs are said to be portable if they run on several different computer systems.
Program	As a noun, a series of instructions, written in a computer language, that the computer carries out in sequence. As a verb, to write the instructions.
RAM (Random Access Memory)	Computer memory (or store) into which information can be written and then read (or copied). The working memory of the computer, sometimes called read/write memory.
ROM (Read Only Memory)	A chip into which the information has been permanently stored during manufacture and cannot be changed by the user. Information can be copied from ROM, but not put back into ROM. Sometimes called firmware.
Simulation	Use of the computer to model real phenomena.
Software	A general term that refers to all computer programs that can be run on computer hardware.
Spreadsheet	A business package that enables the user to manipulate tables of figures using simple cumulative operations and formulae to combine the various elements of the tables.
Store	Another word for memory, perhaps a better one in that it implies a place where information can be kept or stored until needed.
Telesoftware	Computer programs that are transmitted by telephone line or television broadcast as part of a teletext signal. A special decoder is required at the receiver to turn the information into a signal that can be directly read by a computer.
Teletext	An information service using a small part of a television broadcast signal. With a suitable decoder, the information can be displayed on a home TV set as a series of pages of information.
Videotex	A generic term for communications systems which use the telephone and modified television type receivers to provide two-way transmission of digitally encoded forms of information.
VDU (Visual Display Unit)	Usually a screen of the television type, on which the output of the computer can be displayed.
Workstation	A term that refers to a microcomputer or terminal that may operate as a stand-alone unit or which may be connected into a network.
Z 80	An eight-bit microcomprocessor of the Zilog family found in a large number of microcomputers. CP/M-80 runs on the Z80 chip.

APPENDIX

H

STATEMENTS OF DISSENT

F G SHARPE

As the representative of the Department of Education of NSW I must record my dissent from recommendation 40 of the report of the National Advisory Committee on Computers in Schools. The reasons for my disagreement with this recommendation and the statements in the report leading to it were stated at the last two meetings of the Committee by me and by the officer representing me in my absence.

NSW regards as totally unacceptable the proposal to limit support within the Commission's Program to the models of computers designated in the recommendation. Dissent from the proposed list is based on the following issues:

(1) NSW has never supported the concept of standardisation of equipment and materials in the sense that the program would support only one or a very small number of computers, with the particular focus being on hardware acquisition. Standardisation based on particular computer models is unlikely, in our opinion, to achieve the positive results hoped for, and may be associated with considerable difficulties for schools, systems and the Commonwealth. We have agreed to the need for co-ordination in the sense of a co-operative program leading to agreed educational specifications for both hardware and software, a process which we would hope would lead ultimately to a smaller range of computer hardware with compatible software being used in Australian schools.

(2) It is a matter of fundamental principle that the selection of equipment in government schools in the various States and Territories is a responsibility which rests with those States and Territories. NSW is currently in the process of making decisions about which models of microcomputers should be placed on the two-year contract for Government schools. Tenders have been received but, as yet, no decisions promulgated about which items of equipment will appear on that list. In that context, it is inappropriate for NSW to commit itself to a program which depends on the use and support of a specific set of microcomputers which may, or may not, comply with decisions taken at the State level.

(3) The arguments given in the report for the selection of the particular models proposed are unconvincing when compared to the very rigorous processes which each of the States goes through when preparing its specifications, considering tenders and making decisions of this kind. In particular, the argument that the selection is based upon decisions taken in some States is unconvincing if quite different deci-

sions have been taken in other perhaps considerably larger States, following similar rigorous processes.

(4) The NSW Department believes that without support being given for some microcomputers which have a relatively low-cost entry point, it is unlikely that the Program will be successful in removing and preventing inequalities in access to computing resources, based on gender, socio-economic background, cultural differences and regional location. Failure to include some low-cost microcomputers will almost certaibly result in an increase in the relative inequality of schools in Computer Education and may compound present inequalities rather than alleviating them.

(5) The exclusion of all 16K models of computers would deny support within the National Program to many schools in NSW and elsewhere which have obtained these models and have found them to be of positive educational value.

In dissenting from the above recommendation, the NSW Department is not denying the economic and educational value which could be obtained from greater levels of compatibility in educational software and courseware. The proposal that co-operative State/Commonwealth activities be undertaken leading to the development of agreed educational specifications for computer hardware and software is fully supported. The outcomes of such activities could be influential, over a period of time, in limiting the numbers and kinds of computers being used in Australian schools and could provide an environment for co-operative educational software development and dissemination at a national level.

F G Sharpe
Director of Studies
NSW Department of Education

20/10/83

P Jeremy

This is to record my dissent from recommendation 40 that four particular microcomputers be supported with funds from the National Program.

I should stress that my disagreement is not with the four computers chosen but with the rationale behind the selection process.

SUMMARY

My disagreement with the recommendation is based on the view that it:

(a) contains implicit assumptions, which are not necessarily correct;
(b) does not solve the problems it is supposed to address;
(c) is a simplistic solution to a very complex problem;
(d) could effectively stifle progress in school computer education for some years; and
(e) has not been justified.

IMPLICIT ASSUMPTIONS

The recommendation carries with it two implicit assumptions:

(a) that the same, or similar, type of equipment is appropriate for all (secondary) schools and for all programs in the school;

(b) that individual microcomputers are, and will continue to be for some time, the best and/or most economical computer education medium.

I do not propose to discuss these issues but merely point out that they are far from clear-cut, that it is difficult to see how any rational approach to standardisation can be made before they are resolved and that they have not been resolved.

THE PROBLEMS

The recommendation revolves around three primary aims:

(a) The need to halt the growing proliferation of computer types being purchased in Australian schools.
(b) The need for some degree of standardisation at the national level.
(c) The possibility of negotiating favourable prices on the basis of a national market.

It addresses the first two of these in a very simplistic way, without addressing the fundamental issues. If anything, it militates against the third.

EDUCATION AND STANDARDISATION

The three issues mentioned above arise quite frequently in the education arena.

The education system is so large that there are quite plainly significant economies of scale involved in providing any kind of 'standard' material or service to all schools. Such economies are usually weighed against the educational consequences.

The purpose of this statement is not to defend the proliferation of computer types in our schools nor to argue against standardisation. However, it should be noted that one of the problems which frequently arises from standardisation is that change becomes difficult.

I contend that:

(a) the most significant economic and educational benefits of standardisation can be achieved by means other than those proposed by the Committee;
(b) the proposal will have long-term educational and economic penalties;
(c) the proposal is likely to exacerbate the problem of difficulty of change; and
(d) a significant degree of flexibility and diversity at the school level can be accommodated, even with a high degree of standardisation, but the Committee's proposal virtually prohibits any local flexibility.

COMPUTERS AND STANDARDISATION

The issue of standardisation with regard to computers is confused because there are overlapping and complementary areas of potential standardisation—hardware, software and courseware. In eductional terms, it is the courseware which is important—the actual nature of the hardware and software is very largely irrelevant, provided it supplies the right environment for courseware. Courseware is very expensive to produce and there are some severe restrictions on running courseware written for one particular environment in a different environment. However, it is feasible to define a standard environment, for which courseware will be written. It is most unlikely that many computer suppliers could provide this standard environment immediately; modifications to software would be required. However, it would be provided fairly quickly once it became a condition of purchase. Under some circumstances it might even be worthwhile for the necessary modifications to be made by education authorities. The latter would stand to make significant savings by writing courseware for one environment rather than writing it three or four times for three or four different computers.

Whilst there is a great deal of incompatibility between different computers, this can be overcome. In my view, priority should have been given to the definition of the environment for which courseware would be developed. The actual choice of computer hardware then becomes a separate, subsequent issue.

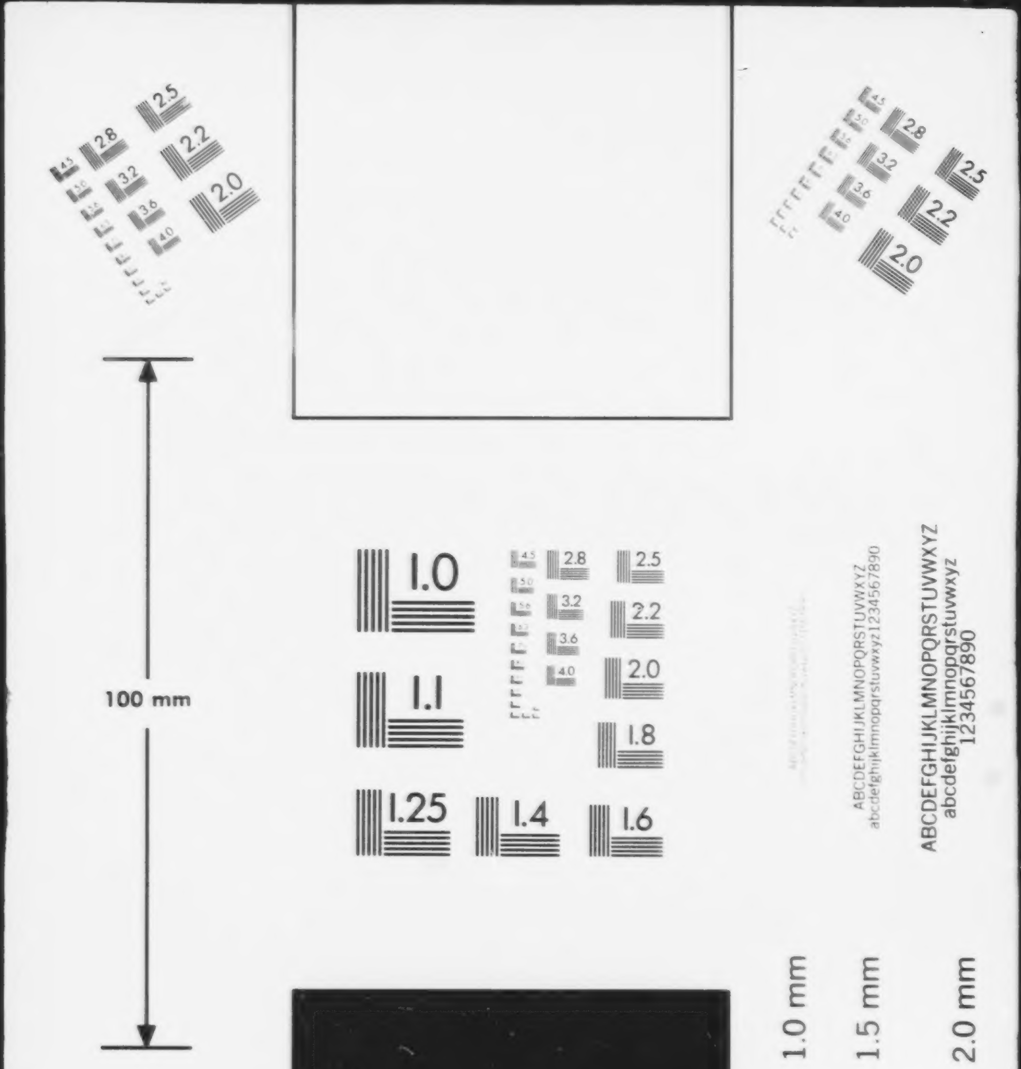
This would then leave the actual choice of computer to the local school, subject to the usual benefits relating to State Government Contract equipment. It is important that the final choice be made at the local level, so that the school's particular planned educational programs can be accommodated. A school may be satisfied that the limited courseware available on a smaller machine is quite adequate for the particular program it wishes to provide and, hence, may wish to purchase more of a cheaper and less powerful computer than the ones recommended. At the other end of the spectrum, some schools may wish to purchase larger computers for special purpose courses, such as Advanced Computer Studies. Schools may even wish to purchase computers having particularly good facilities in a specific area on which they wish to concentrate.

The problem of flexibility and diversity within a school is a major concern and it must be admitted that a standard environment does not solve the problem. However, it is feasible to develop different levels of the standard environment, each level being a subset of the one above it. Writing courseware for highly compatible, but different, levels does not suffer the same cost penalties as writing it for totally different, and incompatible machine environments. The notion of levels of a standard environment is not pursued further here, but it is an avenue which needs to be explored. The recommendation inhibits flexibility at the local school level without providing any significant benefit in return.

STANDARDISATION AND TECHNOLOGICAL CHANGE

In an industry changing as rapidly as the computer industry, the view of standardisation implicit in the Committee's recommendation is bordering on the absurd.

It is not inconceivable that a computer could become available next week which is functionally superior to those recommended, but which costs considerably less. To state that the list will be 'reviewed regularly' is not an adequate response to this situation; the review would need to be continuous. Such a review would involve quite a lot of work on the part of the proposed Co-ordinating Committee and/or its working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parties, to determine the validity of the 'functional superiority'. (It is not clear, incidentally, what criteria would be used in such a review.) On the other hand, if the basis for standardisation is a courseware environment, the review would consist of asking the supplier one simple question—'Does your computer provide the defined environment?'

The chief criterion for selecting the recommended computers was their existence on a number of State Government Contracts. If this criterion is valid, it should presumably continue to be valid. Hence, it would appear that before some remarkable breakthrough in computer design could be purchased with National Program funds, the computer would have to be listed on Government contracts in a number of States. These contracts generally last for two years, so it could be some considerable time before schools would be in a position to pass on to their students the benefits of technological progress.

Implicit in the recommendation is the intention that courseware will be 'written for' the particular computers nominated. Writing courseware for a particular computer has the advantage that its functions and facilities can be fully exploited. It has the disadvantage that such courseware must be written within the limitations of the particular computer. These limitations then become a *de facto* standard. This 'standard' has the potential for becoming a severe restriction. As the 'standard' persists over time and as the particular equipment becomes more widely used, there develops an inertial resistance to changing (upgrading) the 'standard', even after the limitations have been removed or relaxed.

The first glimmerings of the process described can be seen in the report. One of the nominated computers is at the end of its product life—it has been superseded by a more advanced model. Under the guidelines outlined on page 44, funds could be provided for the purchase of more such equipment, on the grounds of compatability, thus further increasing the schools' commitment to 'old technology'.

If the list of selected equipment is reviewed regularly, then presumably there will be occasions when the Co-ordinating Committee wishes to place new equipment on the list. There will be considerable pressure to retain the existing list and add the new equipment, thus lengthening the list of 'standard' equipment. The alternative is to remove equipment from the list of supported computers, thus rendering obsolete a large number of school computers.

The problems touched on above are a direct consequence of concentration on computer hardware. A further consequence, incidentally, is that the prime motivating force in the processes described is not the educational needs of school students but the equipment that computer suppliers happen to put on the market.

The notion of a standard courseware environment does not by any means completely eliminate the problems but it does lessen their impact. It is envisaged that the standard environment would be continually evolving to accommodate and anticipate technological advancements. Schools and suppliers could be given ample warning that changes to the standard environment are to be made, that as from a certain date courseware will be written for an improved environment. Schools, in particular, will have some time in which to modify and/or expand their educational programs. This is in stark contrast to the Committee's approach, which has the effect of virtually obsoleting a large number of school computers almost overnight.

EFFECTIVENESS OF THE PROPOSAL

One of the major objectives of standardisation is the easy exchange of courseware between States and between schools. The most practical method of transmitting courseware is, at present, via diskette and this method is recommended by the Committee. The different methods of reading/writing diskettes used by the selected computers are such that diskettes written on one type of computer cannot be read by another type, and vice versa. Hence, in many cases, schools will not be able to exchange courseware. The problem is not so severe regarding exchange between States, who will presumably have access to all of the types selected. However, at least two versions of courseware will need to be sent from one State to another. (Actually, because the courseware will be written 'for' specific types of computers, three or four versions will be required.)

The prime source of proliferation of computer types in Australian schools seems to be the wide variety available under various State Government Contracts. It would seem that the correct place to address the problem is at its source. I understand there are legal problems in allowing these contracts to be influenced by the recommendation. Hence it would appear to be ineffective in its impact on the very source of the problem. On the other hand, I understand that there is very little difficulty in a State accepting an agreed national courseware standard as a major factor in the tendering process. This would almost automatically reduce the number of computers on State Government contracts.

It is difficult to see the proposal being any more effective at the school level. The funds allocated for the National Program are so woefully inadequate that there will be very little to offer the average school in the way of services, courseware or hardware. Making the allocation of funds conditional on the use of the specified computers is rather like hitting nails with a rubber hammer.

The unfortunate aspect of this is that the impact of that rubber hammer is likely to be felt most by those who can least afford the alternative. The funds available are such that parents will still be required to provide the bulk of funds for computer purchases. The parent groups who are most likely to be aware of the emptiness of the implied sanctions are precisely those who can afford to purchase, and may have already purchased, alternative equipment. Hence the students who will benefit most from any technological progress are those in schools which, in all probability, are getting along quite well without a National Program. The schools most in need of the National Program funds will be forced to accept the recommended equipment, even though it may not be the most appropriate for their students, or even the cheapest.

COMMERCIAL REALITIES

The propriety of nominating brand names in a report of this nature is, at best, questionable. No matter how frequently the recommended list is updated, the three suppliers nominated will be able to continue quoting an official publication to support their claims of educational superiority. It is difficult to envisage a process by which the promulgation of an updated list will carry the same force.

One of the reasons for attempting to standardise at the national level was to allow for price negotiations at the national level. The recommended machines are already on Government contracts in a number of States at quite favourable prices. Once the nominated machines are known publicly, there is virtually no incentive for the suppliers to negotiate a further reduced, national price. They will be able to argue, perhaps justifiably, that they are already offering the lowest possible prices at State level and simply cannot afford to reduce them further.

COMPLEXITY OF THE ISSUE

The points discussed so far demonstrate quite clearly that standardisation raises many more complex issues than just deciding which four of a myriad of computers will be supported by the National Program.

LACK OF JUSTIFICATION FOR THE RECOMMENDATION

There is little or no justification for the recommendation. In order to justify the support of a limited number of specific computers, the following would need to be provided:

(a) Information as to the level of compatibility across the nominated group of computers as compared with that across other groupings.
(b) An indication of the extent to which full compatibility might be achieved across the nominated group.
(c) Evidence that there was some correlation between the functional capabilities of the nominated machines and the educational objectives defined by the Committee.
(d) Some indication of the extent to which the particular choice would aid or inhibit transition to the proposed especially designed computer.
(e) An assessment of the impact on schools which have purchased other types of computers—where courseware would be quite useless, where it could be modified, the effort required for modification, etc.
(f) Evidence that the nominated computers could cover the wide range of within-school requirements.
(g) Evidence that the best way to achieve standardisation is to limit the number of types of computers to be supported.
(h) An indication of the specific benefits to be achieved from the measure.

Virtually none of this has been provided.

The paragraph beginning 'The recommendation to restrict hardware purchases . . .' on page 45 provides some indication of the considerations used by the Hardware Working Party in reaching its recommendation. No specific information on any of these items was provided to the Committee. The principal justification offered, and reflected in the report, was the selection of the nominated computers by several State Departments of Education. The criteria used for a national program would not be identical with those used for a State program. For instance, the requirements for servicing facilities would almost certainly be different.

The following paragraph in the Report suggests that the Committee has 'declined to . . . (make a specific recommendation regarding the lower level hardware in use in many schools) ... based on the advice of its Hardware Working Party . . .' The Hardware Working Party did not offer any advice regarding lower level hardware.

In summary, there is virtually no justification for either the proposal to limit support to a small group of computers or for the selection of the particular group.

AN INTERIM MEASURE?

Great stress is laid on the 'interim' nature of the recommendation. At the same time, it is to last for 'at least two years' and also it is to be 'regularly reviewed'. It is difficult to reconcile these three ideas, particularly when applied to a program to which the Government has currently indicated its commitment for only three years.

The Committee has recommended a procedure (Appendix E) aimed at locating on the market, or having developed, a computer which is particularly suited to the requirements of Australian schools and which is preferably manufactured in Australia. The necessarily rigorous procedure described is such that it could well be five years before this computer is available in Australian schools.

The use of the terms 'interim', 'short-term' and 'reviewed regularly' cannot disguise the fact that the recommendation ties schools down for a substantial period of time, for no real purpose.

THE FUTURE

One of the recommended suppliers recently won a most significant court case in the United States. The case concerned copyright over machine-level functional design. The effect of the ruling is that any manufacturer producing a computer which is compatible with this one at the machine level is in breach of copyright. In other words, courseware written 'for' the particular computer cannot legally be run, without substantial change, on another computer. This raises the question of whether the particular supplier has been automatically granted a permanent place in the Australian education market, or whether all the courseware written 'for' it will have to be re-written.

Obviously there needs to be some bridge from the recommended computers to the especially commissioned computer. One would anticipate that its specifications would include the capability to run courseware written for the currently recommended computers. As noted above, any attempt to provide machine level compatibility with at least one of these computers is likely to result in a lawsuit. A far more logical approach is to ensure that no courseware is written 'for' any particular computer but is written to match a particular environment, thus ensuring its portability between computers. Unless steps are taken along these lines now, the Australian education authorities could be faced with the enormous expense of re-writing, or making major changes to, the courseware written between now and the advent of the Australian computer.

CONCLUSION

Whatever the case for or against some level of standardisation nationally, the key educational, and probably economic, benefit arises from ensuring that courseware is easily transported between different makes of computer. This can be achieved by defining a standard environment, which must be provided by any supplier wishing to enter, or remain in, the education market.

Within the context of this standard environment, the actual choice of computer should be made at the school level.

Unless courseware is written to match a standard environment, there is a very strong possibility that the proposed Australian computer may not be able to run courseware written for its predecessors.

The notion of writing courseware 'for' a particular computer, or group of computers, has the potential of locking Australian school students into a technological backwater.

The emptiness of the implied sanctions is such as to have little effect on the problem of proliferation at school level. There are grounds for doubting its effectiveness at State level. In the longer term, as the sanctions do become significant, the negative effects will become more severe and more costly to correct.

There is little likelihood of any significant computer price reductions as a result of the Committee's recommendation.

In summary, this recommendation is, at best, likely to be ineffective in solving the problem it supposedly addresses and, at worst, likely to have serious negative effects on computer education in Australian schools. In contrast, virtually no positive benefits have been identified in support of the proposal.

Paul Jeremy
ACSSO Representative

COMMONWEALTH
SCHOOLS COMMISSION

REPORT ON COMPUTER EDUCATION

Response to the Report of the
National Advisory Committee on
Computers in Schools.

CANBERRA, MARCH 1984

COMMONWEALTH SCHOOLS COMMISSION

CHAIRMAN

PO Box 34, Woden
Australian Capital Territory 2606
Telephone (062) 89 7124

Senator the Hon. Susan Ryan
Minister for Education
and Youth Affairs
Parliament House
CANBERRA ACT 2600

Dear Senator Ryan,

On 28 July 1983, you issued Guidelines to the Commonwealth Schools Commission for the year 1984. In those Guidelines, the Government looked to advice from the Commission to enable the implementation of a national Computer Education Program.

Since receiving the Guidelines, the Commission has had the benefit of the Report of the National Advisory Committee on Computers in Schools. That Report of the National Advisory Committee contained fifty-two recommendations, and the Commission has formulated its advice based on those recommendations.

In accordance with the Guidelines, I have pleasure in forwarding the Commission's advice for the 1984 Computer Education Program.

Yours sincerely,

P.D. Tannock (Chairman)
15 December 1983

1984 COMPUTER EDUCATION PROGRAM

In April 1984 the Commission appointed a National Advisory Committee on Computers in Schools to provide it with advice on the use of computers in schools and in particular on issues related to the establishment of a National Computer Education Program. The Committee was asked to outline a rationale for a national program as well as providing advice on an implementation plan and associated guidelines for its introduction.

In the Guidelines which the Government provided to the Commission for 1984, it indicated that $18m (December 1982 prices) would be made available during 1984-86 to support a Computer Education Program. In 1984 an amount of $6m was to be available for this purpose, of which $4.8m was for government schools and $1.2m for non-government schools.

The Commission received the report of the National Advisory Committee on Computers in Schools early in October 1983. Given the interest that the work of the Committee had engendered within the community and the fact that the Commission believes it extremely important that Australian schools have access to a carefully planned and implemented computer education program, the Commission decided that before it provided you with advice on the recommendations of the National Advisory Committee the report should be distributed widely to education authorities and interest groups for comment.

It was unfortunate that the Commission was not able to provide a longer time for comment. Several respondents drew the Commission's attention to this problem. When the Commission discussed the Committee's report at its 98th meeting, some 26 responses had been received. The Attachment lists the organisations and individuals who had responded to the report by the time the Commission met.

Most departments, individuals and organisations indicated that they were in substantial agreement with the report. That is, they agreed with both the philosophical base of the report and most of its specific recommendations on priorities for funding under the new program. There were, of course, some disagreements with a few of the recommendations, notably in relation to hardware limitations. A minority of respondents either disagreed strongly with the Committee's proposal to limit the number of machines eligible for funding under the program or expressed reservations about the process by which the recommendation was arrived at. Some concern was also expressed that the problem of rapid obsolescence of computer technology had not been sufficiently addressed in the report nor the broader area of education and the new information technologies. Some criticism was made of the software and courseware recommendations. In particular, concern was expressed regarding the recommendations related to computer programming languages.

A number of respondents commented on the need for computer education at the primary level. There was strong support for a national computer program which provided support from K through to year 12.

The great majority of respondents indicated that the level of funding provided to the program in 1984 was nowhere near sufficient to support adequately the activities and program envisaged in the report.

COMMISSION RESPONSE

The Commission believes the report of the National Advisory Committee provides a sound basis for the planning and introduction of a national program. The Commission supports the overall direction of policy and implementation recommended by the National Advisory Committee. It would like to reiterate its belief that the introduction of a comprehensive computer education program is essential if Australian schools are to provide their students with an adequate preparation for the society in which they live. The Commission endorses the statements made by people who responded to the report that the level of funding provided in 1984 is not commensurate with the task confronting schools.

While the National Advisory Committee's terms of reference did not ask it to address the broad issue of education and the new information technologies, it is important to stress that education related to the technological revolution must be seen as part of the total curriculum. Schools must be encouraged to take up educational programs relating to and using new technologies in a manner which places such programs within the context of the total curriculum. With the introduction of new technologies in the schools, the Commission believes that it is essential that the social, economic, political and cultural consequences of the new technologies be carefully examined. The new technologies themselves can be seen as neutral; however, the way that they are introduced into schools can have a major impact on the learning process. The Commission strongly supports the National Advisory Committee's statement that one of the underlying principles involved in education and new technologies is the need to move towards more equal educational outcomes in students.

The Commission supports the recommendation of the National Advisory Committee to give priority initially to the professional development element. In the Commission's view the effectiveness of the program will relate directly to the level of skills within the teaching force. It is the Commission's view that for the program to develop it will be essential for teachers to be provided with the necessary time to come to an understanding of the computer technology and be able to work through the issues related to integrating the technology in the total curriculum. As indicated earlier the Commission supports the rationale, objectives and principles for the national program, as outlined in Chapter 3 of the Committee's report. It endorses the operational principles underlying the program which are also outlined in Chapter 3 and would draw special attention to the need to involve the total school community in decisions related to the use of computers in schools. At the school level the Commission believes it is important that parents, teachers, and students are all involved as much as possible in the decision-making process related to the purchase and use of computers in schools.

In terms of the discussion on issues related to curriculum and the use of computers in schools, the Commission endorses the approach taken but would draw a greater distinction between computer awareness and computer literacy than is undertaken in the report.

In sum, the Commission supports most of the recommendations contained in the National Advisory Committee's report. Following are specific comments on the Committee's recommendations.

RECOMMENDATIONS ON CURRICULUM DEVELOPMENT

The Commission endorses Recommendations 1, 3, 4, 5, 6, 7 and 8. In relation to Recommendation No. 2, that immediate support be given to the establishment of a national mechanism for the dissemination of information about curriculum issues and that the reactivated Curriculum Development Centre be closely involved in this task, the Commission would recommend that before any action is taken on this recommendation it be referred to the Curriculum Development Centre for comment.

RECOMMENDATIONS ON PROFESSIONAL DEVELOPMENT

The Commission supports Recommendations 9 through 17. In relation to Recommendation 10, the Commission assumes that the reference to disadvantaged teachers relates to teachers working in conditions or areas which make the provision of services related to the use of computers in schools difficult. While supporting Recommendation 14, and acknowledging the important role of the school principal, the Commission believes that unless the whole school staff are involved (possibly through elected staff committees) maximum benefit will not be gained from professional development programs in the computer education area. The Commission strongly endorses the comments made in Chapter 4 of the report on the whole area of professional development.

RECOMMENDATIONS ON SUPPORT SERVICES

Recommendations 18 through 27 are endorsed.

RECOMMENDATIONS ON SOFTWARE

Recommendations 28 through 38 are endorsed. In relation to Recommendation 35, a number of respondents commented that the range of languages was too limited. While accepting the recommendation of the National Advisory Committee, the Commission recommends that the area of computer programming languages be referred to the proposed National Co-ordinating Committee for urgent advice.

RECOMMENDATIONS ON HARDWARE

The Commission supports Recommendation 39 and believes it essential that the research and development begin immediately. In relation to Recommendation 40, the Commission believes that any hardware purchased with program funds should be able to meet the broad curriculum needs and software and courseware specifications outlined in the Committee's report. To this end, support should be concentrated on the more powerful and versatile machines and not lower-level hardware. Subject to the endorsement of this guideline, the Commission recommends that for 1984 program funds be available to purchase computer hardware which is on the appropriate State Education Department 'approved list'. These restrictions should apply to both government and non-government schools. For 1985 and beyond, hardware policies should be the subject of consideration by the proposed National Co-ordinating Committee, in consultation with State and non-government school authorities and interest groups.

If the Commission's recommendation on the hardware to be purchased is accepted, then Recommendation 41 is redundant. The Commission endorses Recommendations 42 to 46. In supporting Recommendation 45, the Commission is aware that in the short term this may mean that all money spent on hardware will be in declared Disadvantaged Schools and schools serving other needy communities.

RECOMMENDATIONS ON ORGANISATION

The Commission endorses Recommendations 47,49,50,51 and 52. In relation to Recommendation 48, the Commission believes that it would be more appropriate for separate non-government co-ordinating committees to be established in each State rather than have the program administered on the advice of the Commonwealth Schools Commission's State Planning and Finance Committees. While endorsing Recommendation 51, that the Curriculum Development Centre give priority to the computers in schools area, the Commission has assumed that this recommendation means that the Centre gives high priority to the area not necessarily exclusive priority. In relation to Recommendation 50, the Commission sees that one area which should receive immediate attention is the establishment of procedures to allow for a longitudinal study to be started which traces the impact of the use of computers in schools on students.

News Release

M16/84

Minister for
Education & Youth Affairs

19 February 1984

COMPUTER EDUCATION PROGRAM

The federal Minister for Education and Youth Affairs, Senator Susan Ryan, today released Commonwealth Schools Commission and Government decisions on the new Computer Education Program.

The Hawke Government has committed $18.7-million for this initiative over the three years from 1984. In 1984, grants of $6.234-million will be made, $4.987-million to government, and $1.247-million to non-government schools.

Senator Ryan pointed out that the Commonwealth was a partner with State Governments and non-government school authorities in the program. "Both government and non-government schools wanted the Commonwealth to come in, and the National Advisory Committee on Computers in Schools developed a detailed consensus about the direction of a national policy."

The States had already begun their own initiatives, and would maintain their effort in this area. The Commonwealth money, which would be in addition to that effort, would have a significant impact Senator Ryan said.

"The Commonwealth will be a partner, sensitive those emerging needs which can best be met by central support and co-ordination," she said.

Senator Ryan emphasised two points about the program:

* "We are making a national effort to bring a high standard of technological awareness and skill among all Australian children, which is the way towards sharing the rewards of technological change among all Australians.

* "We are going to approach computer education in terms of a broad educational program, rather than simply as an exercise in hardware provision. The central themes here are building a capacity to generate Australian content with sound educational values across the broad range of school subjects; and developing a teacher force capable of using computers to the advantage of all children in school."

Summary

- *Recommendations of the Advisory Committee.*
- *Advice of the Commonwealth Schools Commission.*
- *Government decisions.*

CURRICULUM DEVELOPMENT

NACCS RECOMMENDATION	*SCHOOLS COMMISSION ADVICE*	*GOVERNMENT DECISION*
1 Curriculum development activity take place within and between the existing curriculum development structures and agencies at the national and State levels.	ENDORSED	ACCEPTED
2 Immediate support be given to the establishment of a national mechanism for the dissemination of information about curriculum issues (including evaluation) which arise from the introduction and extension of computing in schools and that the reactivated Curriculum Development Centre be closely involved in this task.	ENDORSED subject to consultation with the Curriculum Development Centre prior to implementation.	ACCEPTED subject to consultations with Curriculum Development Centre and funding to be derived from within existing sources.
3 The first priority for curriculum be the provision of computer awareness and computer literacy experiences for all students in the years of compulsory secondary schooling.	ENDORSED	ACCEPTED
4 A second priority is to promote the integration of computing into the school curriculum, in primary as well as secondary schooling.	ENDORSED	ACCEPTED
5 A third priority is the provision of optional computer studies courses at the secondary level, to allow studies at some depth.	ENDORSED	ACCEPTED

NACCS RECOMMENDATION	*SCHOOLS COMMISSION ADVICE*	*GOVERNMENT DECISION*
6 Special consideration in funding be given to the development and implementation of curricula for girls, students living in isolated area, Aboriginal students and those coming from other racial and ethnic minorities, students who are socio-economically disadvantaged, and disabled students.	ENDORSED	ACCEPTED
7 Funds be made available to investigate the effects of computers on the learning environments of particular groups of students.	ENDORSED	ACCEPTED subject to funds being found from within existing sources.
8 Encouragement be given to the development of curriculum materials and processes which provide greatest opportunities for learners' success, and for co-operative group learning as distinct from individualised competitive learning.	ENDORSED	ACCEPTED

PROFESSIONAL DEVELOPMENT

NACCS RECOMMENDATION	*SCHOOLS COMMISSION ADVICE*	*GOVERNMENT DECISION*
9 In 1984 Professional development activities in the computers in schools area be given high priority in the allocation of funds from the Computers in Schools Program and from the Commonwealth's Professional Development Program.	ENDORSED	ACCEPTED
10 Delivery mechanisms developed by States and systems should pay particular attention to the full participation of women teachers, non-mathematics and -science teachers and disadvantaged groups amongst teachers. It may be necessary to provide special courses for these groups.	ENDORSED with the understanding that 'disadvantaged teachers' refers to teachers working in conditions or areas which make the provision of services related to computers difficult.	ACCEPTED with that understanding

NACCS RECOMMENDATION	*SCHOOLS COMMISSION ADVICE*	*GOVERNMENT DECISION*
11 Participation of men and women in professional development activities reflect their proportion in the teaching service on a State-by-State basis.	ENDORSED	ACCEPTED in principle
12 In the implementation of delivery systems for professional development, existing structures be used and further developed.	ENDORSED	ACCEPTED
13 In implementing the professional development component of the Program, States and systems choose from a selection of alternatives. Among the options available are long and short courses, the establishment of mobile consultancy teams, school networks, action research, audio-visual tutorials, television courses in and out of school time and regional, State and national conferences.	ENDORSED	ACCEPTED
14 In any projected professional development schemes the central role of the school Principal be recognised and reinforced.	The Commission acknowledges the important role of the principal. However, the whole school staff should be involved (possibly through elected staff committees) to obtain maximum benefit from professional development programs in the computer education area.	ACCEPTED with the Commission's qualifications
15 Tertiary institutions engaged in the pre-service education of teachers include in the courses of all students, studies of the application of computers to education. It is recommended that the Commonwealth Schools Commission discuss with the Tertiary Education Commission ways in which this could be achieved over the next Triennium.	ENDORSED	ACCEPTED

NACCS RECOMMENDATION	*SCHOOLS COMMISSION ADVICE*	*GOVERNMENT DECISION*
16 Efforts be made to identify, to make known and to support persons who are able and are prepared to provide leadership in schools computing. These people should be assisted to keep in touch with world-wide developments and to set up among themselves a mutual support and information network for the benefit of schools and systems.	ENDORSED	ACCEPTED
17 Teacher associations in all subject areas be encouraged to allocate a segment of their conference programs to the applications of computer use in their subject areas.	ENDORSED	ACCEPTED

SUPPORT SERVICES

18 States be encouraged to commit some of the Program funds allocated to them to hardware and system software in support centres.	ENDORSED	ACCEPTED
19 The feasibility of joint access to support centres for both government and non-government schools in each State or region be explored.	ENDORSED	ACCEPTED
20 Discussion be initiated with the Commonwealth Tertiary Education Commission to identify tertiary institutions with access to appropriate expertise. Consideration be given to funding a support facility in each institution which will increase the number of teachers with substantial expertise in computing topics including, if possible, a study of computer science.	ENDORSED	ACCEPTED

NACCS RECOMMENDATION	*SCHOOLS COMMISSION ADVICE*	*GOVERNMENT DECISION*
21 As the provision of co-ordinated support services is best made through the establishment or further development of comprehensive centres or units in each State or Territory, funds be used to supplement the recurrent costs associated with the establishment or expansion of such centres or units.	ENDORSED	ACCEPTED subject to funds being available from within existing sources.
22 The guidelines associated with funding for centres and units allow for operational costs of regional and district facilities.	ENDORSED	ACCEPTED
23 Provision be made to allow for the flexible use of funds consistent with the functions and services desribed in this Report.	ENDORSED	ACCEPTED
24 A National Computing Network based on these centres be established progressively to support the co-operative and integrated nature of the national program.	ENDORSED	ACCEPTED subject to funds being available from within existing sources.
25 Consistent with the maintenance of effort within each State and Territory, funds from the national program be made available for the training and associated operational costs of consultants and also for the employment of additional consultants.	ENDORSED	ACCEPTED
26 Special measures be taken to appoint qualified women within the support structures for computing in schools. This may require the development of employment and training policies to increase the number of women with suitable qualifications and/or teaching experience.	ENDORSED	ACCEPTED

NACCS RECOMMENDATION	*SCHOOLS COMMISSION ADVICE*	*GOVERNMENT DECISION*
27 The importance of supporting teachers in schools, not only through the services described, but also by encouraging initiative at the school level and facilitating the sharing of such developments and information through the centres and units be recognised. Small grants should therefore be made available for the support of innovative practice in schools.	ENDORSED	ACCEPTED

SOFTWARE/COURSEWARE

28 General purpose software for word processing, spreadsheet, database and statistics/data reduction be available from program funds for the recommended hardware.	ENDORSED	ACCEPTED
29 As a matter of urgency the Commonwealth Schools Commission establish mechanisms to: (i) provide for the acquisition, adaptation or development of general purpose and subject specific software and courseware; (ii) allow for appropriate marketing procedures; (iii) assess the continuing software and courseware needs of the schools.	ENDORSED	ACCEPTED subject to funds being available from existing sources and advice from the CDC.
30 In establishing these mechanisms the Commission work closely with the Curriculum Development Centre in providing appropriate support and implementation structures.	ENDORSED	ACCEPTED
31 The mechanisms referred to above be funded initially by the Commonwealth but should aim to generate adequate income to become self-sufficient in the longer term.	ENDORSED	ACCEPTED

NACCS RECOMMENDATION	*SCHOOLS COMMISSION ADVICE*	*GOVERNMENT DECISION*
32 Software/courseware intended for widespread use be developed using a team approach with the team consisting of teachers, programmers and other qualified personnel as required.	ENDORSED	ACCEPTED
33 Software development aids be available to assist teachers to develop software/courseware for their own use, e.g. graphics tablets, light pens, language compilers, programming standards.	ENDORSED	ACCEPTED
34 Development work be carried out in centralised computer centres where appropriate.	ENDORSED	ACCEPTED
35 With regard to computer programming languages, in the short term the following be supported: (i) for students, at least LOGO, Pascal and BASIC available for the supported hardware; (ii) for software production, the versions of BASIC available for the supported hardware, LOGO, Pascal and hardware dependent machine code where appropriate.	ENDORSED	ACCEPTED
36 In the longer term: (i) the set of languages for student use be reviewed regularly; (ii) the feasibility of an interpreter/compiler for a single dialect of a language suitable for software development on all supported hardware systems be investigated; (iii) a study be undertaken to investigate the use of fourth and later generation languages.	ENDORSED	ACCEPTED
37 The National Program only support software and courseware that meet valid educational needs and is free of sex role stereotyping, racial or social bias and which facilitates progress to more equal educational outcomes.	ENDORSED	ACCEPTED

NACCS RECOMMENDATION	*SCHOOLS COMMISSION ADVICE*	*GOVERNMENT DECISION*
38 The draft document covering design methodology, design specifications, programming, coding and packaging be completed to a stage where it is suitable for publishing and when published the document should be made available as a guide to teachers and other software and courseware developers.	ENDORSED	ACCEPTED
HARDWARE		
39 Hardware research and development be undertaken as outlined in Appendix E of the report of the National Advisory Committee. i.e. the Commonwealth Schools Commission to lead in education aspects; and the Department of Science and Technology to lead in equipment and system aspects.	ENDORSED	ACCEPTED
40 In the short term the following microcomputers be supported for the purchase of hardware, the provision of maintenance and the development of software and courseware. • BBC Acorn (with or without Z80 and CP/M support • Microbee 64 • Apple II/IIe	NOT ENDORSED The Commission believes that any hardware purchased with program funds should be able to meet the broad curriculum needs and software and courseware specifications outlined in the Committee's report. To this end, support should be concentrated on the more powerful and versatile machines and not lower-level hardware. Subject to the endorsement of this guideline, the Commission recommends that for 1984 program funds be available to purchase computer hardware which is on the appropriate State Education Department 'approved list'. These restrictions should apply to both government and non-government schools. For 1985 and beyond, hardware policies should be the subject of consideration by the proposed National Co-ordinating Committee, in consultation with State and non-government school authorities and interest groups.	The Schools Commission's advice is ACCEPTED

NACCS RECOMMENDATION	*SCHOOLS COMMISSION ADVICE*	*GOVERNMENT DECISION*
41 Support also be provided for professional development and consultancy activities directed at other machines recommended by participating systems.	If the Commission's advice in regard to (40) is accepted, this is redundant.	The School's Commission's advice is ACCEPTED
42 The list of microcomputers to be supported under the program be regularly reviewed in the light of changes in technology and school's needs.	ENDORSED	ACCEPTED
43 Where financial support is provided to schools for the purchase of microcomputers, the guidelines outlined in Chapter 5 of this report apply.	ENDORSED	ACEPTED
44 In the short term funds for the purchase of hardware constitute a minor part of the overall funding of the Program in each State and sector.	ENDORSED	ACCEPTED
45 Priority in the provision of funds be given to Disadvantaged Schools and others serving needy communities.	ENDORSED	ACCEPTED
46 An investigation be carried out as soon as possible as to the feasibility of achieving a national purchase price for hardware.	ENDORSED	ACCEPTED

ORGANISATION

47 For government schools the Program be administered on the advice of representative Committees;	ENDORSED	ACCEPTED
48 For non-government schools the Program be administered on the advice of the Commonwealth Schools Commission's State Planning and Finance Committees;	NOT ENDORSED The Commission recommends separate non-government co-ordinating committees in each State and Territory for the computer education program rather than add this responsibility to that of the existing Planning and Finance Committees.	The Schools Commission's advice is ACCEPTED

NACCS RECOMMENDATION	SCHOOLS COMMISSION ADVICE	GOVERNMENT DECISION
49 A National Co-ordinating Committee on Computers in Schools be appointed;	ENDORSED	ACCEPTED
50 The National Co-ordinating Committee on Computers in Schools develop procedures for the effective evaluation of the Program and for research and development activities;	ENDORSED	ACCEPTED
51 The Curriculum Development Centre give priority to the area of computers in schools;	ENDORSED with the understanding that this does not imply exclusive priority.	ACCEPTED, with this understanding
52 Where other Commonwealth Education Programs are used to support activities and the purchase of equipment related to the use of computers in schools, the principles and specifications applying to the Computer Education Program will apply.	ENDORSED	ACCEPTED

Administrative and Funding Guidelines

Each year the Commonwealth Schools Commission publishes and sends to all schools the administrative and funding guidelines for its grants programs. *Program Guidelines 1984* had, for the first time, a chapter on computer education.

Computer Education Program

INTRODUCTION

10.1 The Computer Education Program will be introduced for the first time in 1984. The Commonwealth Government has indicated that it will provide $18.7m in the period 1984 to 1986 to support the program. An amount of $6.234m is available in 1984.

10.2 During 1983 the Commission appointed the National Advisory Committee on Computers in Schools to provide it with advice on the most appropriate way of implementing a computer education program. The committee presented its report, *Teaching, Learning and Computers* to the Commission in October 1983. The Commission subsequently provided its own advice to the Government which was accepted. Copies of the National Advisory Committee's report are available from Australian Government Publishing Service bookshops in the States and Territories. Details of the Government's final decisions on implementation of this program may be obtained from the Commission's State and Territory offices. These Program Guidelines incorporate and reflect those decisions. The text of the Commission's advice and the Government's response on the implementation of this program will be forwarded to each of the proposed State Committees.

OBJECTIVES

10.3 The Commission believes that the following principles should be followed in the introduction and administration of the program :

- The program should be broadly based and not limited to the provision of hardware.
- Computers should be introduced and used in schools in such a way as to support greater equality of outcomes in education.
- There should be community involvement in the decision making process, with consensus being sought regarding the allocation of resources at school, state and national level.
- The needs of girls and students from disadvantaged groups should be given special attention.
- The primary responsibility for deciding on the allocation of resources among the program components should rest with states, systems or schools as appropriate.
- The program will concentrate initially on secondary schools.
- A co-ordination mechanism should be established at regional, state and national level.
- Wherever possible consideration should be given to co-ordination of activities between government and non-government schools.

10.4 The effectiveness of the program will be heavily dependent upon the skills and motivation of the teaching force. For the program to develop it will be essential for teachers to be provided with the necessary time and opportunity to come to an understanding of computer technology and to be able to work through the issues related to integrating the technology into the total curriculum. At the school level it is important that the school community be involved as much as possible in the decision-making process related to the purchase and the use of computers in schools.

10.5 In 1984, the first year of the Computer Education Program structures will be established and principles developed which will lay the foundation for the development of the program for several years. For this reason considerable thought should be given to the establishment of guiding principles for the program in the various States and Territories and as much liaison between sectors and across State boundaries as possible should be undertaken. The Commission will try to ensure that this liaison is sponsored and that there is co-ordinated development of policy through its proposed National Co-ordinating Committee.

FINANCIAL ALLOCATIONS

10.6 Table 10.1 shows the distribution of Computer Education Program funds among the States and Territories for government and non-government schools in 1984.

TABLE 10.1

Allocations for the Computer Education Program, 1984

State/ Territory	Government Schools	Non-Government Schools	Total
	$'000	*$'000*	*$'000*
N.S.W.	1 545	337	1 882
Vic.	1 282	339	1 621
Qld	676	176	852
W.A.	447	114	561
S.A.	482	106	588
Tas.	239	71	310
N.T.	136	31	167
A.C.T.	180	73	253
TOTAL	4 987	1 247	6 234

PROGRAM STRUCTURE

10.7 The program will provide support for a broad range of activities related to the use of computers in schools. Specifically, funds will be provided for the following elements:

- *Professional Development*
- *Curriculum Development*
- *Software and Courseware*
- *Hardware*
- *Support Services*
- *Evaluation*

Professional Development

10.8 The Commission believes that in 1984 priority should be given to this area. In providing professional development activities there is a range of approaches which might be used including central short or long courses, consultancy teams, development of school networks, action research, the use of audio-visual techniques and regional, state and national computer education conferences. In developing professional development activities, particular attention should be paid to encouraging the participation of non-mathematics and non-science teachers and female teachers in the activities provided. As the Commission expects that some funds provided under the Professional Development Program will also be used to support computer education activities, it will be necessary for education authorities in the States and Territories to establish a mechanism to ensure that co-ordination between the two programs is provided.

Curriculum Development

10.9 The first priority in this area should be the provision of computer awareness activities for all students in the years of compulsory secondary schooling. The second priority should be to promote the integration of computing into the school curriculum; while the third should be the provision of optional, in-depth computer studies courses at the secondary level. The Commission also believes that special consideration should be given to the development and implementation of curricula which meet the particular needs of the disadvantaged groups for whom the program should have a special focus.

Software and Courseware

10.10 Program funds can be used to develop and purchase software and courseware. The Commission has endorsed the recommendations of the National Advisory Committee on Computers in Schools in this area and it is recommended that schools and authorities study these recommendations before programs are developed. Where software and courseware are being developed which it is intended to use widely in schools, a team approach is most beneficial. Teams should consist of teachers, programmers and other qualified personnel.

Support Services

10.11 If the program is to be implemented successfully it will be essential that support be provided to teachers and other members of school communities. This support may take many forms including:

- Appointment of consultants.
- The establishment or further development of comprehensive computer education centres or units.
- The inservice education of consultants.

10.12 It is very important that teachers be supported in schools not only through the services described above, but also, by encouraging initiative at the school level. To this end consideration should be given to the provision of grants to support innovative practices in schools. The amount of funds provided for such grants need only be small.

Hardware

10.13 While funds can be used for the purchase of hardware and associated equipment, the Commission would expect that a minority of the total funds available to any system will be spent in this area. The Commission believes that any hardware purchased under the program should be able to meet the broad curriculum needs and software and courseware specifications outlined in the National Advisory Committee's report. Hardware purchased with program funds should be concentrated on the more powerful and versatile machines, and not lower level hardware. With this qualification program funds may be used to purchase computer hardware which is on the appropriate State Education Department approved list. This guideline applies to both government and non-government schools. Where funds are provided for the purchase of hardware and associated equipment, priority should be given to disadvantaged schools and others serving needy communities.

ADMINISTRATION

10.14 The Commission will be appointing a National Co-ordinating Committee on Computers in Schools. This committee will recommend on national activities to be supported under the Projects of National Significance computer education element, provide advice on national projects, develop proposals for the evaluation of the impact of the program and develop options on the possible future policy directions. It will also advise on the need to review objectives and principles in the light of experience with program implementation, and provide a focus for the development of hardware and software policies.

10.15 The reactivated Curriculum Development Centre will be giving priority to the computers in schools area in 1984. It is expected that the Centre will undertake a number of activities following discussion with the National Co-ordinating Committee including:

- The production of a resources handbook outlining the issues involved in curriculum planning for the use of computers in schools.
- The production of resources which could be used by students and teachers in teaching and learning activities associated with computer awareness and computer literacy activities.

GOVERNMENT SCHOOLS

10.16 For government schools each State and Territory Minister for Education will appoint a Computer Education Co-ordinating Committee which will have responsibility for advising on the administration of the program in government schools. This committee will be responsible for recommending on procedures, principles and priorities within a particular State or Territory.

10.17 The Commission believes it is important that the committee have a representative structure. Membership should include representatives of the Commonwealth Schools Commission, the State or Territory Education Department, parent and teacher organisations, the computer industry and an officer with experience in equal opportunities work, and the chairperson of the non-government Computer Education Co-ordinating Committee. In terms of the teacher organisation representative, consideration should be given to appointing a teacher involved in the work of the State or Territory computer education group. As far as practicable, the committee should have balanced representation of male and female members.

10.18 Under the *States Grants (Schools Assistance) Act* 1983, it is necessary for the Commonwealth Minister for Education and Youth Affairs to approve the computer education programs in relation to government schools. State Computer Education Co-ordinating Committees should arrange to have the program proposals forwarded to the Commonwealth Schools Commission, which will then arrange for Ministerial consideration. In forwarding the proposed programs State committees should provide broad summaries of the various projects and programs recommended, and include an indication of the level of funding it is proposed to allocate to the various elements of the program (see paragraph 10.7). Advice should also be provided of the manner in which the Commonwealth program relates to the initiatives of the State from its own resources.

NON-GOVERNMENT SCHOOLS

10.19 For non-government schools the Commission will arrange for the appointment of committees to recommend a program in each State. These committees will have a similar composition to the government school committees. The Commission will contact the non-government authorities in each State and the parent and teacher organisations to arrange for the appointment of the committee. To ensure maximum co-ordination and co-operation between the government and non-government school programs, it is suggested that the chairperson (or his or her delegate) of the government committee be a member of the various non-government committees and vice versa. The functions and obligations of the non-government school committees will be very similar to that of the government school committees. Non-government committees will forward details of the recommended program to the Commission, which will then seek Ministerial approval.

JOINT COMMITTEES

10.20 While the funds for the program have been provided separately for government and non-government schools there is no reason why, subject to agreement between the various parties at the State level, a joint committee could not be established to advise on the administration of the program for both government and non-government schools.

EVALUATION

10.21 The Commission believes that the evaluation of the program is most important. As with all Commission programs it will be necessary for evaluation to be undertaken at various levels. For its part the Commission, on the advice of the national co-ordinating committee, will undertake a national review of the impact of the program. State co-ordinating committees should make sure that some of the available funds are spent on evaluation. Such funds could be used to evaluate programs at the school level as well as the impact of the Computer Education Program on a State wide basis.

ACCOUNTABILITY

10.22 The Commission will be entering into discussions with government and non-government education authorities about the accountability arrangements for this program.